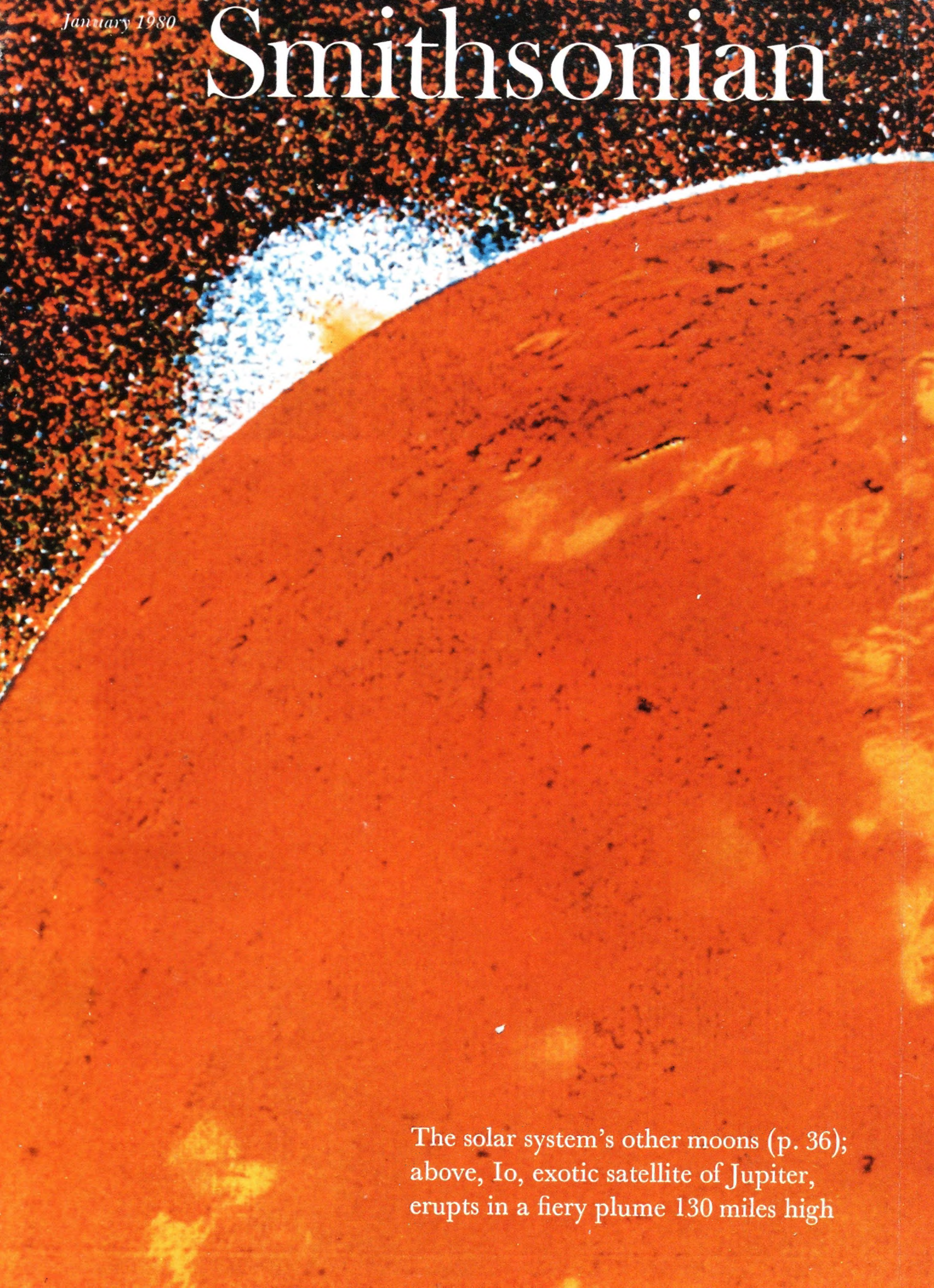
January 1980

Smithsonian



The solar system's other moons (p. 36); above, Io, exotic satellite of Jupiter, erupts in a fiery plume 130 miles high

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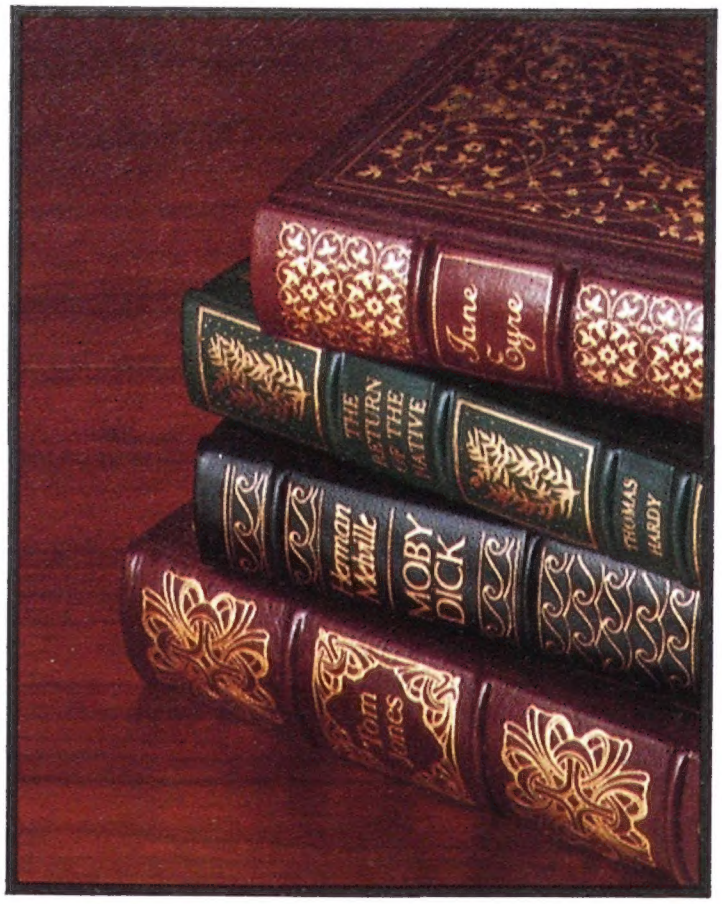

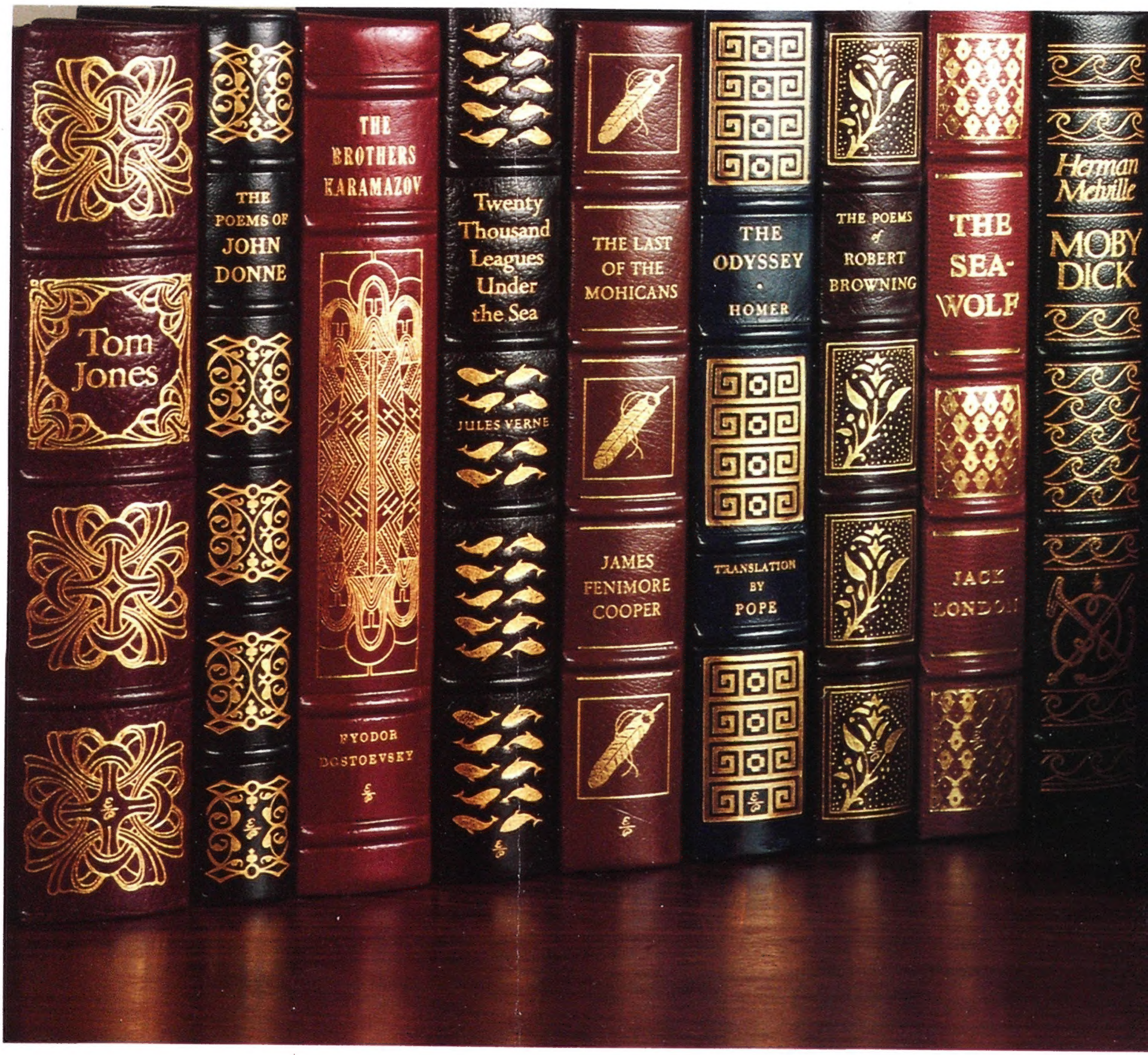

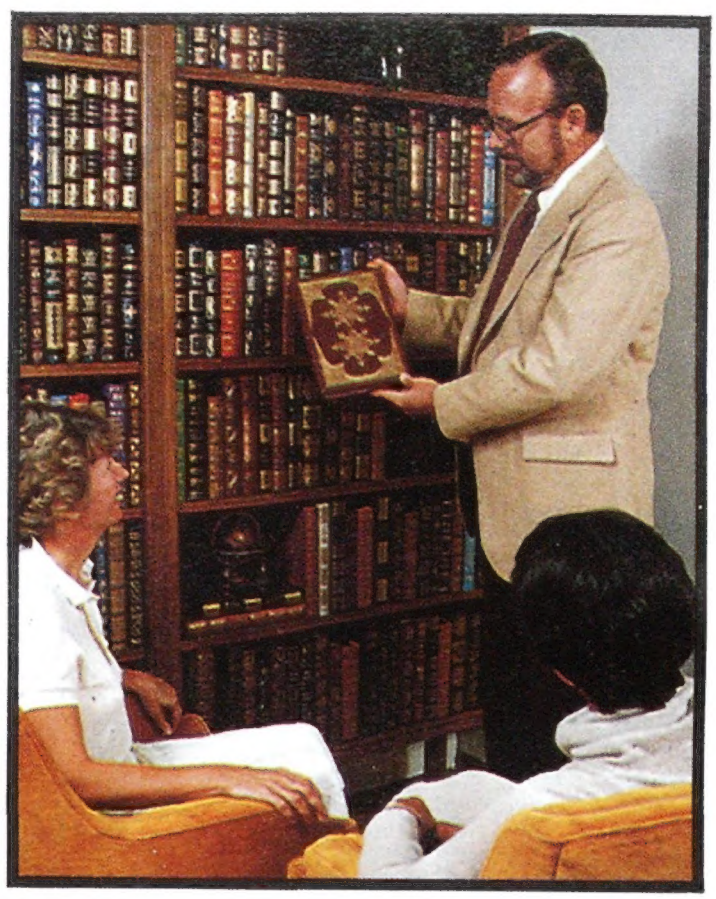

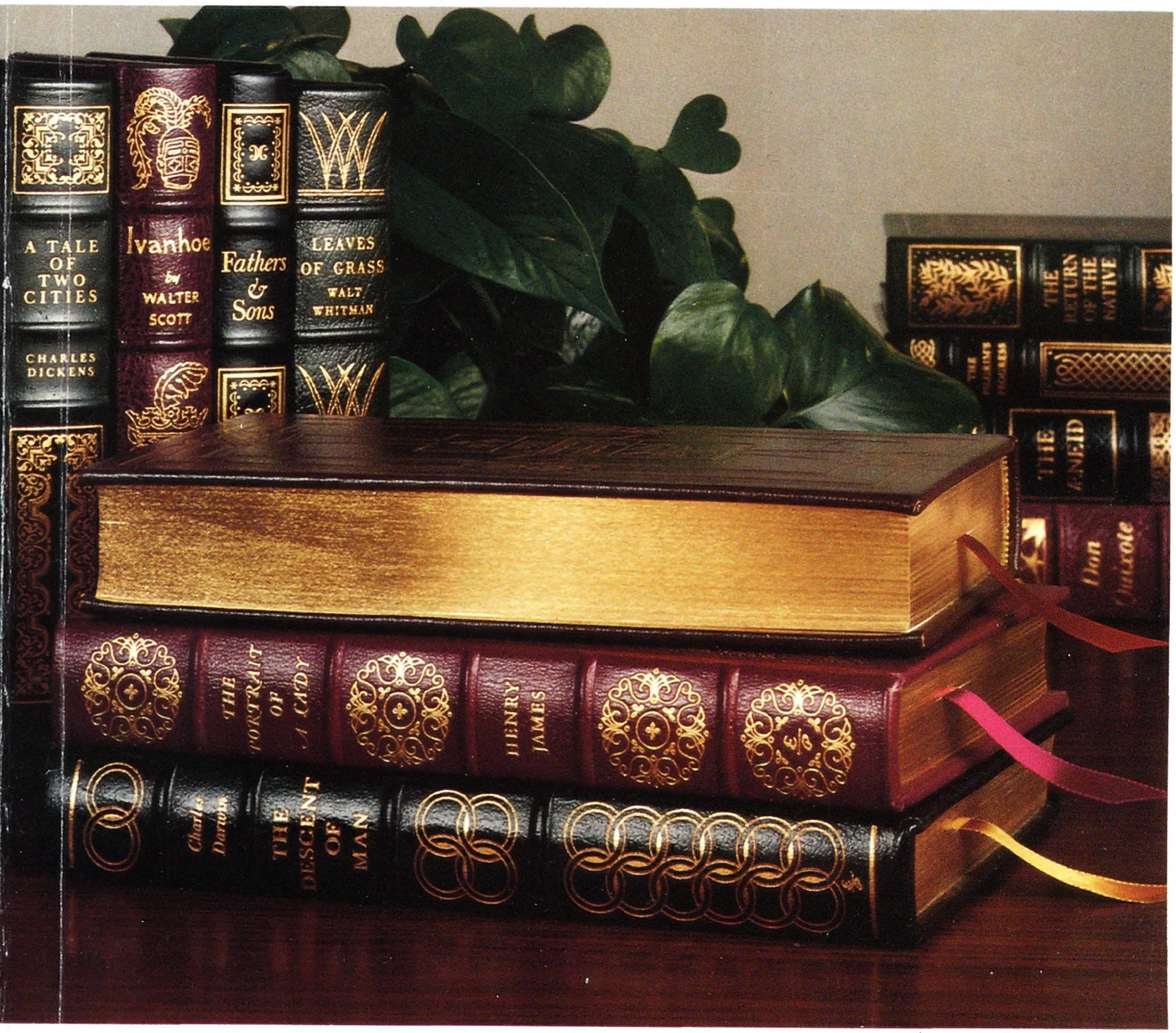
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Smithsonian

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Only the best go to the Olympics.

Nothing in the world of competitive sport can match the Olympic challenge. It is a challenge that demands not only the best in human athletic achievement, but a determination that can be summoned up to overcome seemingly impossible obstacles. Yet with all the talent, skill and dreams the Olympic Games focus into crystal clarity for a brief instant, there can be only a few who wear the gold.

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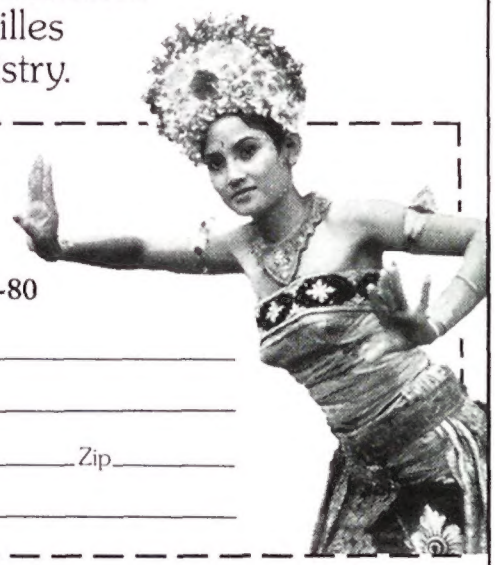

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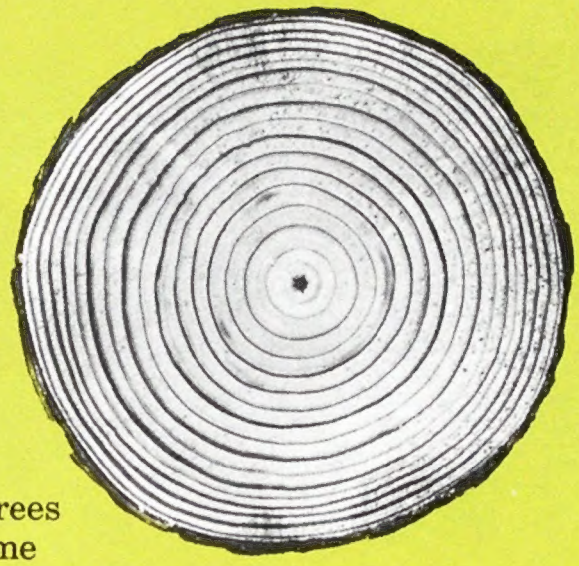
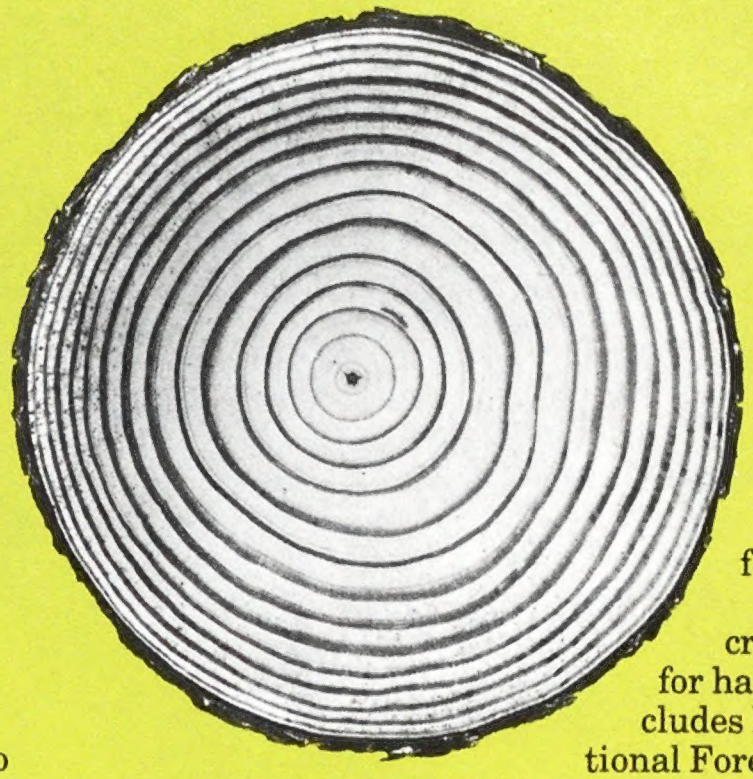
A report on the great American forest.

Look what happens when Mother Nature gets a little help.





These log slices dramatically show the value of modern, scientific forest management. Both (shown 36% of actual size) are from trees of about the same age. The smaller one grew in an unmanaged, overcrowded stand where it had to compete for sunlight and moisture. The other is from a grove that was thinned to give the best trees room to thrive.

This is just one of many ways forest management can help meet a predicted doubling of domestic demand for wood and paper products in the next 50 years.

The forest industry has learned how to help Mother Nature grow more trees, faster, by applying scientific forest management techniques: encouraging natural regrowth, planting superior seeds and seedlings, fertilizing, protecting against disease and insects, thinning, watching carefully until time to harvest — then starting the cycle again.

Demand keeps rising.

Forest management like this is vital because every year Americans need more homes, more paper products, more packaging and containers, more fuelwood, more of the thousands of other essential products that only the forest can provide.

So far, the country's commercial forest has been able to keep up with demand. (*Commercial forest,* as defined by the U.S. Forest Service, is *all* forestland—whether owned by individuals, government or the industry—that is capable of, and potentially available for, growing repeated crops of trees for harvest. It includes land in National Forests but not in National Parks or Wilderness areas.)

But trees aren't grown equally fast by all commercial forest owners. Though industry has made striking advances on its lands, productivity is lower on privately owned lands and seriously lagging in National Forests.

Productivity not up to potential.

Overall, the U.S. Forest Service estimates average productivity of all commercial forestland is only 61 percent of potential. And at the same time, actual acreage in commercial forests keeps shrinking, as land is withdrawn for homes, highways and other needs of an expanding population.

So we as a nation still have a long way to go if our wood and paper products are not to become scarce and expensive.

If you'd like to be better informed on how important it is to keep America's forests productive, write American Forest Institute, P.O. Box 873, Springfield, VA 22150 for a free booklet, "The Great American Forest."

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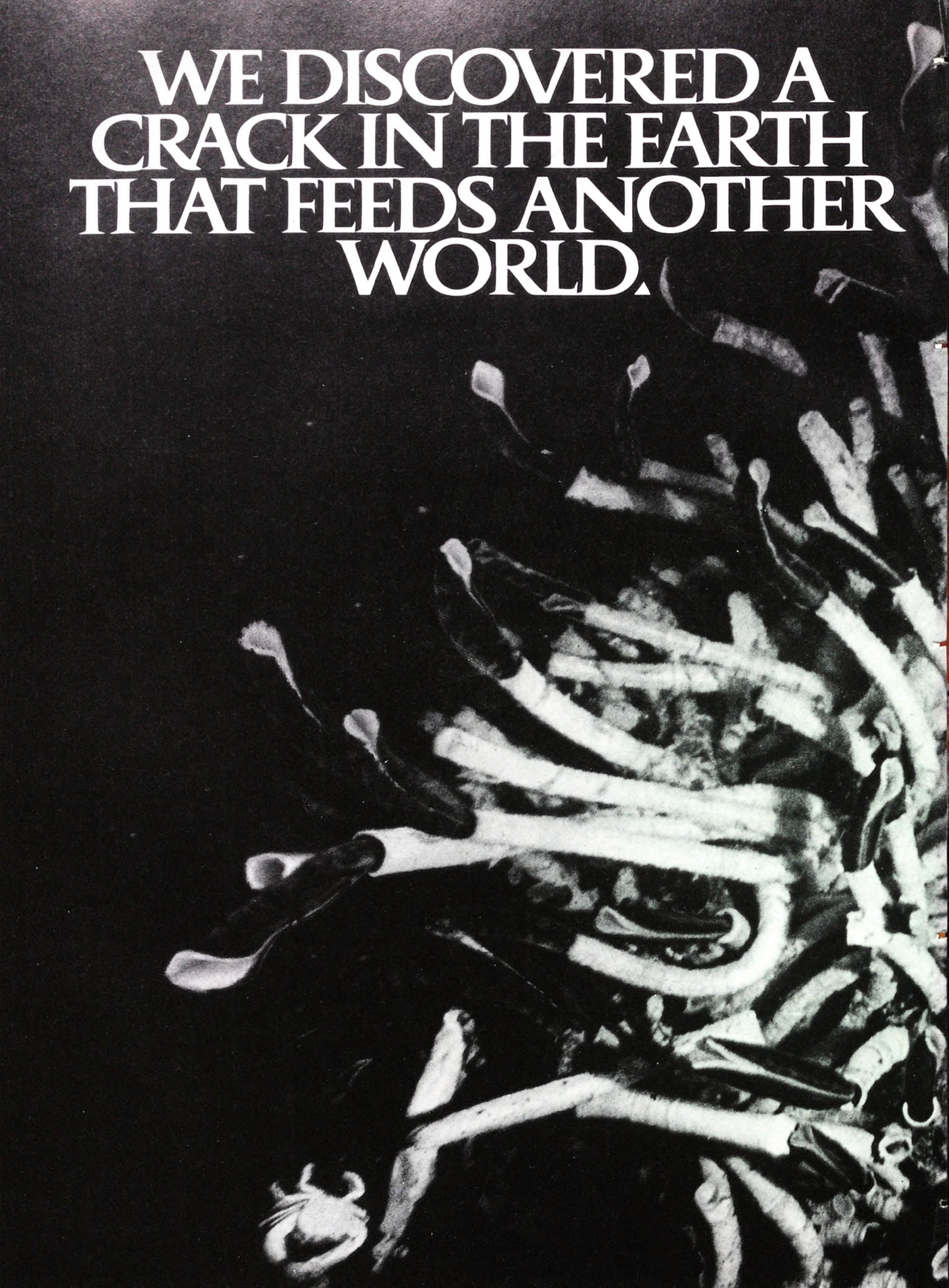

On the Pacific Ocean floor 210 miles off the Galapagos Islands, scientists found life that thrives on chemicals from the Earth's crust.

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Secretary Ripley's comments

The view from the castle

A century ago, as yet another decade began, the Smithsonian exchanged information with more nations than did our government

As we leave behind the Seventies, whose turbulence continued to match that of the disillusioned Sixties, I pause for a moment to reflect on what the Smithsonian was thinking about 100 years ago. The Annual Reports for1879 and 1880 contain only a few references to the temper of the times—concern about the Atlantic Coast commercial fisheries (a matter of pressing interest to Spencer Baird, the new Secretary of the Institution, who was also the U.S. Fish Commissioner), or the election of one of the Smithsonian Regents, James A. Garfield, to the Presidency of the United States. But there is no mention of the financial panics of the recent past.

Of course, the great Centennial Exposition in Philadelphia in 1876 had done much to restore the nation's spirit. Of course, too, we were not then a global power. Conflicts on other continents seemed far away.

Baird was much involved at the time with the creation of a statue of his predecessor, Joseph Henry, scientific hero of the day, who had been memorialized in a public observance in Congress the year before. The correspondence with William Wetmore Story, the sculptor, fills several pages of the 1880 Report. It has a modern ring. Story, on being asked to submit his ideas for the statue and pedestal to the Board of Regents for approval, objects: "There is nothing so dangerous as to interfere with an artist in his design, or . . . criticise it from a small model. . . . No suggestions by any committee . . . will ever make his work good." Amen.

The sculptor is also worried about what clothes Henry should be portrayed in. "The male costume of the present day is crude, graceless, and thoroughly unsculptural." True, he hopes for robes to hide the clothes' ugliness, but supposes that Henry "had no academic costume." (He was eventually reassured.)

When Leonard Baskin set out to create a sculpture of Baird in 1976, the same dilemma presented itself. He wanted to avoid what Story called the "horrible uniformity of the two legs of pantaloons," and so Baird, too, wears a sort of gown from the waist down.

The great new National Museum of the Smithsonian, its second building (now Arts and Industries), was completed in 1880 at a cost of about $300,000, considerably less per square foot than the temporary buildings of the Philadelphia Centennial whose collections it was designed to house. It was to be the greatest and most modern museum of its time.

In terms of the exchange of information, the impact of the Smithsonian abroad was probably greater than that of the U.S. government itself. In 1880 the Smithsonian dispatched documents, publications, research reports and correspondence to some 45 countries and 2,602 international institutions; the government that year had diplomatic missions in 35 nations. Secretary Baird, meanwhile, was hoping that "some of our wealthy men may feel inclined to contribute" additions to the Institution's "perpetual endowment." Alas that so few stepped forward to implement James Smithson's bequest for "the increase & diffusion of Knowledge among men."

It is nostalgic indeed to look back on what seems an easier age than we live in today. But I expect that, if we can master the Eighties with the resolve of our ancestors, we can surmount the sense of anomie, sometimes of disillusion with our country and our institutions, which grips us all. May God so will it.

S. Dillon Ripley

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Today, inflation erodes our economic growth. Inadequate capital investment limits opportunity and undermines our international competitive position. Our companies are hard pressed to keep up with accelerating technological developments. Productivity has been growing much faster in other major industrial nations than it has in the United States.

Why has American economic performance slipped?

Essentially, we seem to have lost sight of what truly drives our economy and what is required to keep our products and services competitive in world markets. Worse, our vision of the future appears to have narrowed to include only that which is politically fashionable and expedient for the short-term.

It is politically fashionable, for example, to charge that company profits are too high... are a "windfall"... or are even "obscene." Yet profits constitute the key support for expanding company facilities, financing new research and development, replacing outmoded and inefficient equipment and, ultimately, ensuring greater productivity, higher wages and more jobs.

It's also politically fashionable to demand greater governmental "safeguards," i.e. regulations on the activities of companies. Yet, each year, government regulations cost our society — both companies and individuals — about $100 billion. Much of which could be used instead for new plants, for new products, for new research, for new technology and to create new jobs. All of which would make us more competitive in world markets.

It's politically expedient for government — in the interest of "protecting the general welfare" — to spend billions of taxpayer dollars on over-regulation without fully weighing costs against benefits. Government overspending, and the resulting federal budget deficit, remains a primary cause of our nation's most serious problem, inflation.

Clearly, we must, as a nation, restore our vision and, with it, our productive capacity.

In the months ahead, we at Chase intend to speak out on the "productive capacity" question: on inflation, on profits, on government regulation, on business investment, on research and development.

Our reason for doing so is quite straightforward. If, as a nation, we are unable to revitalize our productive capacity, Chase's shareholders, customers and employees — together with millions of other Americans — will pay the price. It's a price we need not, and should not, have to pay.

So, we will speak out — as loudly and clearly as we can. We'll do it in our own self interest. And, we believe, in yours.

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Letters to the Editor

Harp seals

Dear Sir: I am shocked and outraged at what I consider a one-sided article, "Bitter fight still rages over the seal killing in Canada," by William McCloskey in your November issue.

There can be no defense of this senseless and bloody slaughter, an aim of which is to furnish "women's sealskin jackets" and "frivolous *toy* seal pups."

The author visited an abattoir and says the seal slaughter is no worse than the sight of cattle being killed. I, as a vegetarian, think that the murder of all animals should be abolished. But the comparison is ridiculous—the end product of a seal hunt is just a frivolous fur coat; of an abattoir, meat for food that many Americans consider essential.
Harry Sternberg
Escondido, California

Dear Sir: At last, some intelligent commentary on the harp seal hunt! There is little doubt that the Greenpeace Foundation has done valuable and often courageous work, most particularly in protecting the vanishing whales, but in the case of the harp seal it seems clear that its pleas are generated by and for emotion.
Thomas L. Clancy jr.
Huntingtown, Maryland

Dear Sir: I felt the descriptions of the seal hunt itself glorified the harsh conditions of the hunt—a kind of macho mighty hunter image. I am supposed to feel sorry for this rugged fisherman out there on the ice fighting for his life and his livelihood. As a concerned and intelligent environmentalist with a career of helping people, I am weary to the bone of being accused of putting animals first because I believe in conservation of wildlife and the humane treatment of animals.
Katrin Fletter
Berkeley, California

Dear Sir: As a cattleman, I find William McCloskey's comparison of the slaughter of cattle to that of harp seals thought-provoking, but to me regrettably misleading. Focusing merely on the techniques of slaughter obscures the broader relationship of humans to these two species.

Since the beginning of domestication, it has been in the interest of cattle raisers to improve breeding, provide forage and feed, and apply good veterinary medicine. Most important is the practice of slaughtering the cattle that appear to contribute least to the genetic strength of the species.

Because the slaughter of harp seals is indiscriminate and exploitative, it poses a potential threat to the ecological success of the species. Mr. McCloskey could more convincingly compare the hunting of harp seals to that of bison. The killing of the seals for fur and flippers is disturbingly similar to the onetime slaughter of the American bison for hide and tongue.
Garvin L. Tate jr.
Royse City, Texas

Dear Sir: The Newfies need only look some 40 miles off their coast at Funk Island, which is a living testimonial to Man's feckless destruction of nature's gifts. Funk Island was the home of the great auk. It is now extinct, and all of Man's knowledge and all of Man's energy cannot put a great auk together again.
James A. Grimes
Lauderhill, Florida

Dear Sir: The clothing industry has done miracles in making warm, attractive fake-fur clothing. Why do people need or desire a piece of animal-fur clothing when these alternatives are available?
Linda Alexander
Pennellville, New York

Dear Sir: Being the wife of an Alaska crab fisherman, I understand the Newfoundlanders' need to use their renewable resource, seals. They are regulating the harvest and now we should back off.
Susan Blue
Seattle

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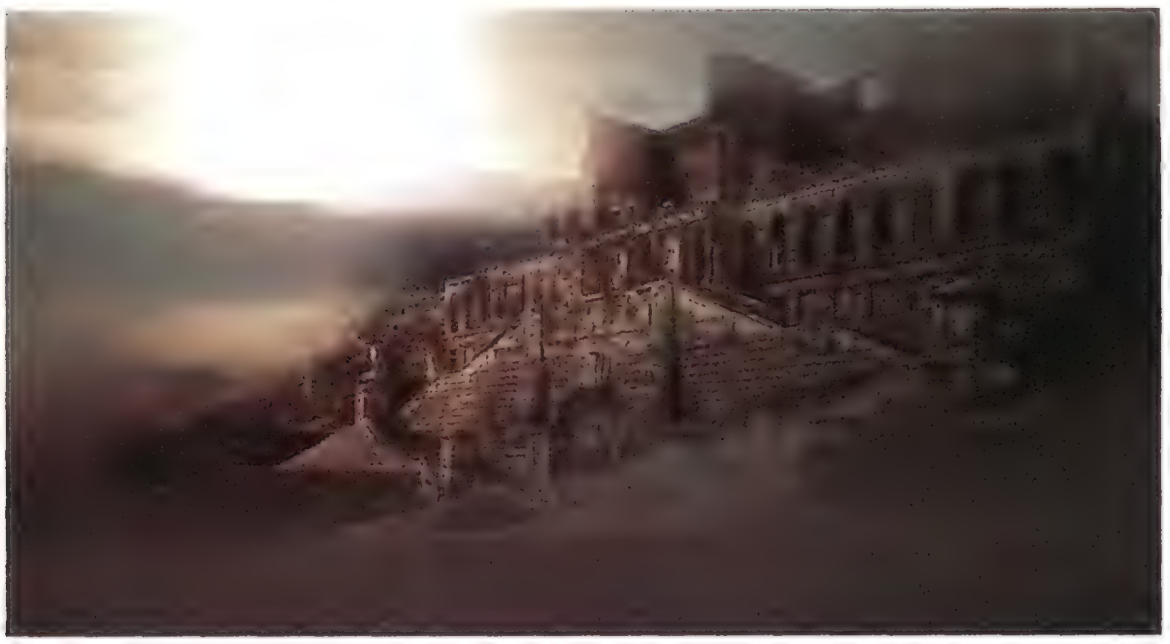

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Dear Sir: I have begun a group in my area to raise funds to protest this awful happening. I hope your article will open more people's eyes and that they, too, will join in protest against this annual hunt.
Martha Gow
Slatyfork, West Virginia

Dear Sir: Having spent some time as a research biologist on the pack ice during the harp seal hunt, I have had an opportunity to observe the sealing, as well as to talk to sealers, fisheries officers and government scientists. It is my opinion that too many articles written about the hunt are smitten with emotionalism and have drawn conclusions without knowing half of the facts. Mr. McCloskey's article, on the other hand, is an excellent example of someone interested in a controversial issue who does his best to gather the facts and, then, in a very straightforward way, presents his observations.
Daryl J. Boness
National Zoological Park
Washington, D.C.

Ancient Chinese army

Dear Sir: I read with great interest the article by Maxwell K. Hearn about the clay life-size soldiers, buried more than 2,000 years ago in China, that have been excavated recently. However, I was puzzled that no clarification was presented when the height of the soldiers ranged from five-feet-nine to more than six feet, and the commander towered at six-feet-five. It was my understanding that people living at that time were generally shorter.
Edward J. Allen
Oliver Springs, Tennessee
Figures were probably scaled on height of tallest males of the era. Leaders represented were arbitrarily made taller. Ed.

American wastrels

Dear Sir: Regarding Robert Osborn's "finger of scorn" cartoons, I am extremely weary of being told over and over again to be ashamed of being an American. Not all Americans are living the soft lives portrayed in the cartoons. Certainly, my husband and I work for what we have.

The finger of scorn should be pointed at government—the greatest waster of time, money, energy, paper and talent.
Jenny L. Sprague
Lacey, Washington

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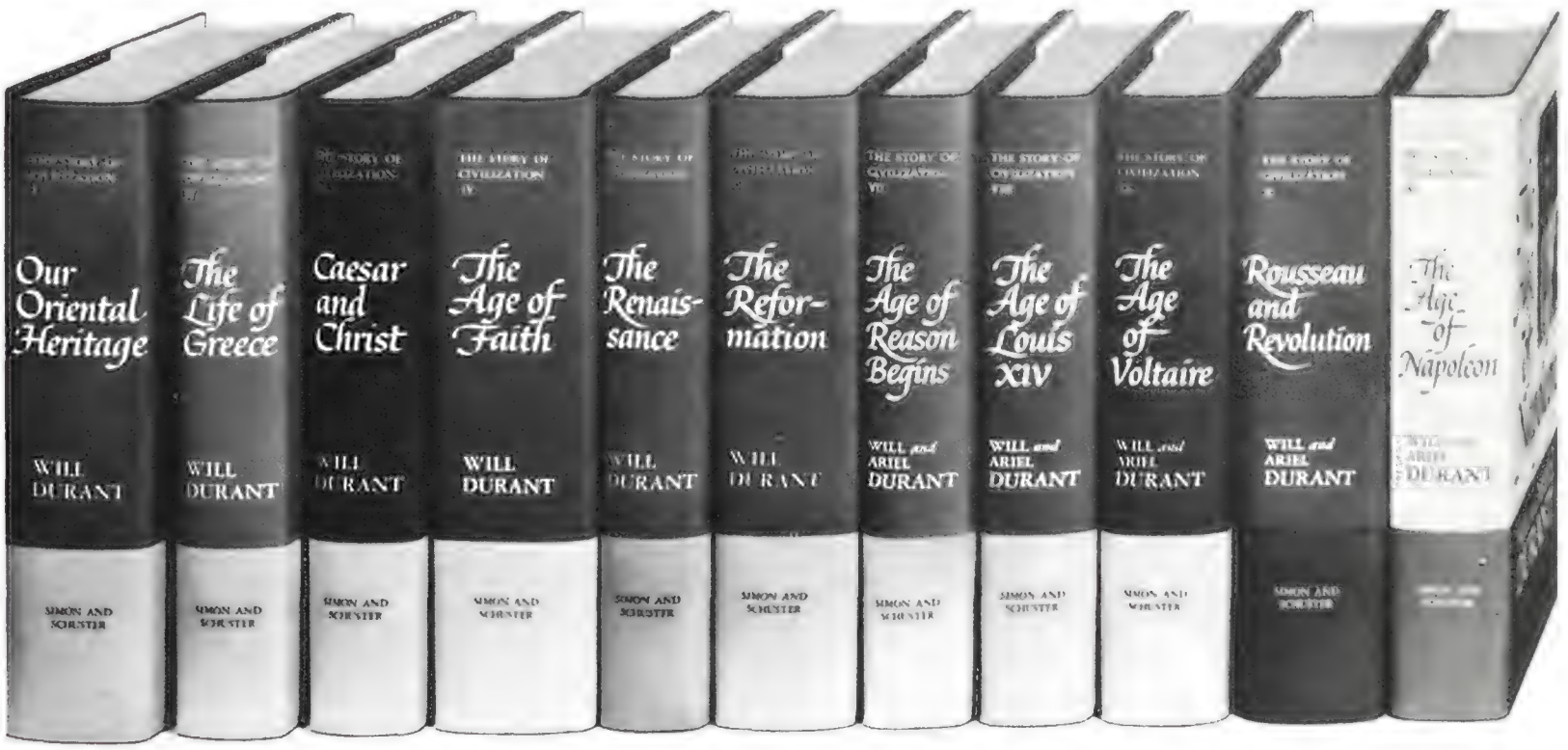

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Dear Sir: Robert Osborn describes our self-indulgence through his art much better than most of us can with words.

Self-discipline seems to be an ugly word for most of us. We are so possessive about our automobiles that we look upon public transportation as a source of embarrassment. We should curtail driving to no more than six days a week, and take a long, leisurely walk to church on Sundays.
Richard V. Grulich
Baldwin, New York

Dear Sir: You state that "Osborn doesn't give his victims of today's world much of a chance to disagree—but, then, neither did Hogarth or Thomas Nast."

Among works which are comparable were Nast's "The whole country is going to the dogs" [at right] and Hogarth's "Gin Lane" [see below].
E. L. Kelly
New York City

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The National Science Foundation, The U.S. Department of Education, and the Corporation for Public Broadcasting all contributed sizable sums to help put *3-2-1 Contact* on the air.

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And we're happy to invite you and your 8-to 12-year old friends to watch *3-2-1 Contact*. See your local TV listings for the broadcast schedule.

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Library thefts

Dear Sir: As David Lampe points out in his article, "Your neighbor in the library may be a thief," the problem is not new but certainly it is worthwhile to draw our attention to the grossly increased incidence of such activity in recent times. The anecdotes he related should be shocking but, in fact, they are all too believable. Apparently, we must now accept the fact that average Americans, in growing numbers, are developing sticky fingers and slippery consciences.

I can remember when our local newspaper boy used a little red wagon to make his deliveries. Nowadays, his successor makes the rounds with a purloined shopping cart. What has become of the little red wagon? Indeed, what has become of our collective conscience?
Kenneth Gaulin
Cambridge, Massachusetts

Dear Sir: In Cameron Gerlach's sketch of thieves spiriting loot from a Yale library, a logo appears at the top of the drawing with the single word "VERITAS." The Yale motto is LUX ET VERITAS. Harvard uses the single word VERITAS, usually broken into three syllables, to make it easier for Harvard students who cannot cope with big words.

Anyway, you have the Harvard motto on a Yale drawing, and you may hear from other Old Blues.
Frank Cole, M.D. (Yale 1930)
Lincoln, Nebraska

Dear Sir: Why VERITAS in a Yale library? I suspect that some acquisitive and ingenious Yaleperson, actual or pseudo, wandered into the Harvard Co-op and stuffed a coat of arms and goodness knows what else under a cassock, caftan, toga or muumuu.
Eleanore M. Kennedy
Warminster, Pennsylvania
Neither Blue nor Crimson, illustrator Cameron Gerlach says his alma mater, Maryland Institute College of Art, treats a motto as just a motto. Ed.

Malapropisms

Dear Sir: The last page was not the least, thanks to John Sherwood's piece on malapropisms. Here are a few gleanings from newspapers I read: "Well, you know how it is; nobody's human" (a former Assis-

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tant Secretary of Defense); "The streets are safe in Philadelphia. It's only the people who make them unsafe" (then-Mayor Frank Rizzo); "But listen to his music sometime and see if you care on which side he parts his hair. It is so beautifully orchestrated" (from a music review in the *Palm Beach Post-Times*).
Helen Johnson
West Palm Beach, Florida

"Hard" problems

Dear Sir: In connection with your timely article, "Trial-and-error game that puzzles fast computers" by Gina Bari Kolata, in the October issue, your readers may be interested in knowing about an intriguing theoretical development that has just occurred in this field. There is a large and very important class of problems, known as linear-programming problems, that arise in a wide variety of contexts such as modeling the national economy, inventory control for large companies and staff scheduling at hospitals. Over the past 30 years efficient methods have been developed to handle most of these problems, at least when their sizes are not too large. However, no one had ever been able to produce a method (or algorithm) that was guaranteed not to blow up (*i.e.*, require exponentially many steps) for a particularly unlucky choice of problem. In fact, it was suspected by some experts that (in the words of the article) linear programming might be an "NP-complete" problem and so there would be essentially no hope in ever finding such a guaranteed efficient algorithm.

Very recently, however, L. G. Khachian, a young Soviet mathematician, has found the long-sought-after algorithm. It is quite different in principle from other methods currently used to attack linear-programming problems, and is basically geometrical in nature, forming smaller and smaller (n-dimensional) regions that rapidly zero in on the desired solution. At present not enough computational evidence is available to know whether this algorithm will have any immediate practical consequences. Many computer scientists are optimistic, however, that Khachian's general technique can be applied successfully to a much wider variety of problems.
Ronald L. Graham
Department of Computer Science
Stanford University
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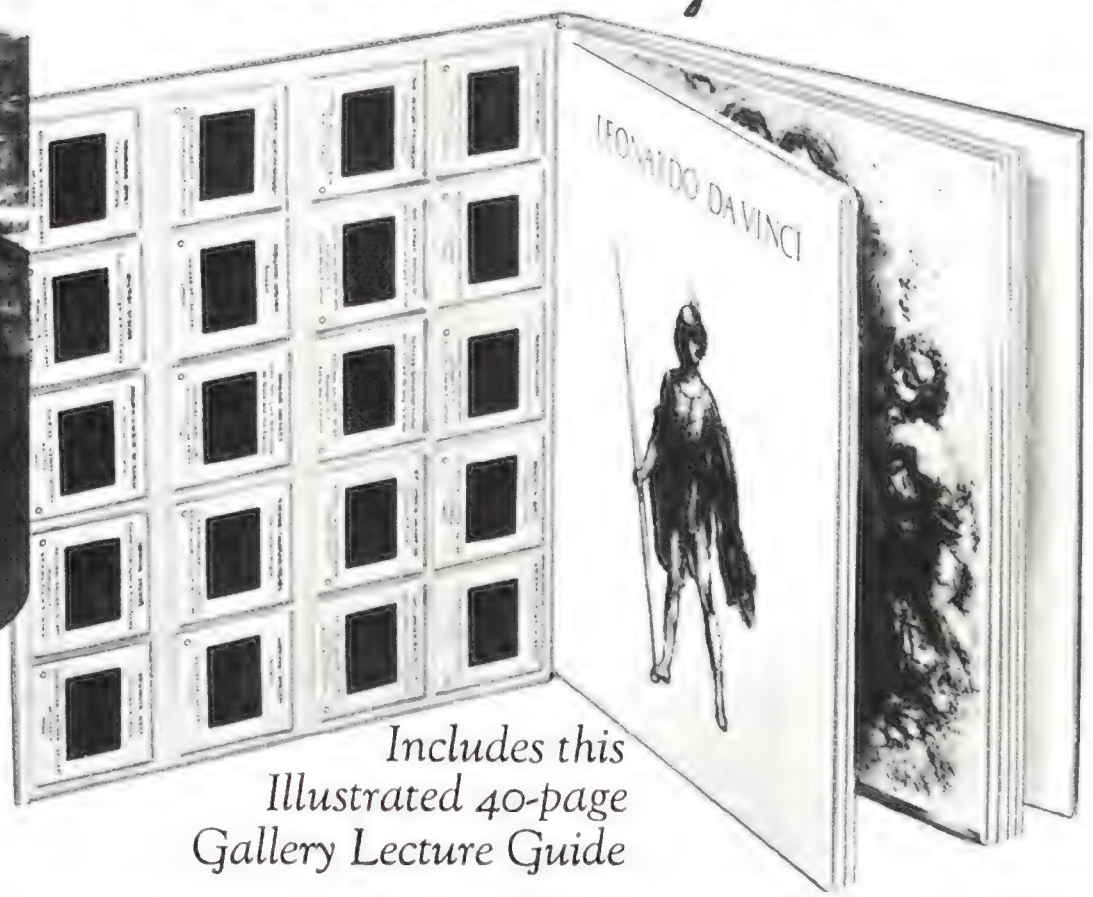

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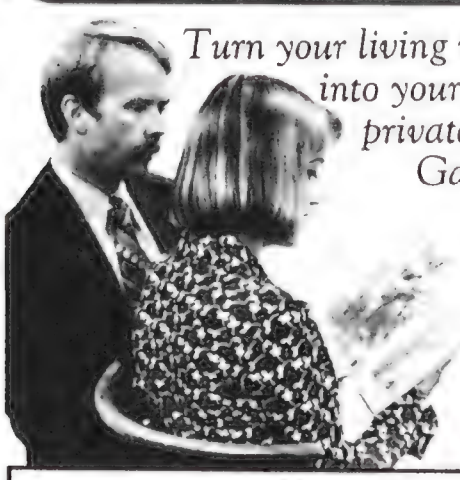

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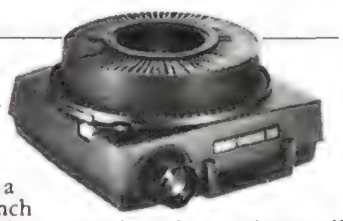

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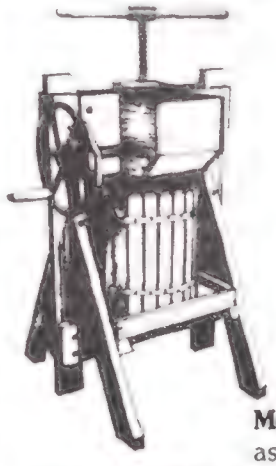

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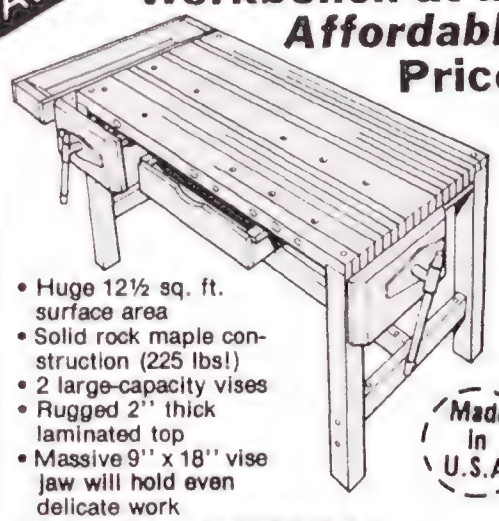

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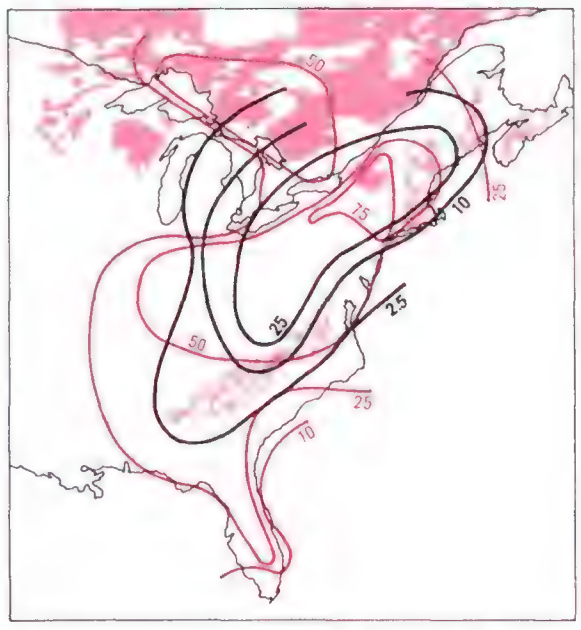
Phenomena, comment and notes



Curves on map of eastern United States show rainfall acidity during the middle 1950s (black) and the 1970s (in color).

Color as a warning to predators, some questions from a nuclear engineer and the fizzing of marble in acid rain

It is raining here as this is written and judging from a map in *Scientific American* (Vol. 241, No. 4), the rain is steadily eroding the tiles of my roof. That's because the rain's pH is wrong—too low, too acid. I don't like to think of a decade beginning with acid rain eroding my roof, but there you are. It's happening. Call it God's will.

No, it isn't. A couple of hundred years ago, rain and snow fell that was neutral—just right for swimming pools and backyard hot tubs (the latter probably not having come into use). Not too acid, not too alkaline. Nice rain. Nice snow, even for those who don't like it. You can check it out on Greenland's ice cap.

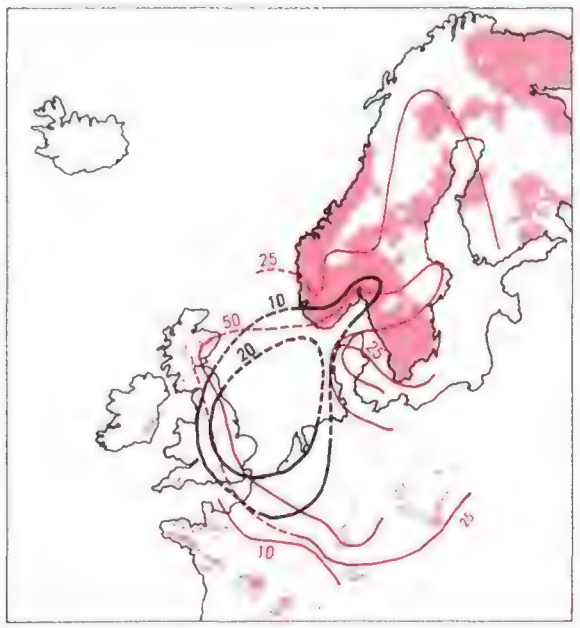
There are lots of things that affect naturally the pH of the rain: volcanic gases, carbon dioxide from animal metabolism, salts from the spray of the sea—all that good stuff. To symbolize the new situation, though not merely to point a finger at a neighbor, there is in Sudbury, Ontario, a stack 400 meters tall, attached in wonderful ways to a copper-nickel smelter. From this stack comes one percent "of the total annual emissions of sulfur throughout the world (from both natural sources and human activity)." Some of that sulfur comes back to us as sulfuric acid in our rain.

I don't mean to sound alarmed about my roof (it will outlast me), but I once talked to a Park Service worthy who said the Lincoln Memorial is turning to mush. You can hear it fizz, he exaggerated, when it rains.

Globally, the worst places for this are in the U.S. Northeast, much of southeastern Canada and northwestern Europe—particularly Scandinavia. All are downwind from major industrial centers, and the acidity of the rain actually increases with distance from those sources. Judging from *Scientific American*'s maps, much of southern Sweden and Norway must fizz when it rains. As our Southwest urbanizes, its getting worse there, too. Same for the Rockies and the West Coast.

What are the environmental consequences? Certain freshwater ecosystems have little resilience. Hence, fish are wiped out along with their support system of plant and animal plankton. What the acidulous effects are on forests and growing crops remain unknown in any overall way—but if the Lincoln Memorial is suffering, it is not alone, you can be sure of that.

The several authors of the *Scientific American* article point out that acid rain is one of the two greatest environmental problems facing the globe in the next decades, the other being the potential climate changes resulting from adding too much carbon dioxide to the atmosphere. Both of these are caused by the headlong combustion of fossil fuels around the globe. We in America will apparently be doing more of this rather than less. If oil runs out on schedule, never mind; we've got coal—a 300-year supply, say some of the ads—and synfuels. We'll turn the Rockies



Similarly in western Europe, the higher the numbers the more acid the rain. In both, shaded areas are most vulnerable.

into gasoline and live it up another decade or so before we bubble off in a sea of acid fizz and leave it to the cockroaches to clean up.

Happy New Decade.

Consider the alternative

Anticoal *et al* means pronuclear, right? Every decade has its problems, and 1980 may see the most intense and, if we are lucky, most intelligent public debate over nuclear power ever.

A few years back a reporter in this magazine could, in a balanced article, say the only problem with nuclear power was not plant safety but what to do with the nuclear waste (SMITHSONIAN, April 1974). The aftermath of Three Mile Island shows that both problems are very much with us. Another question asked in these pages (SMITHSONIAN, December 1974) was if nuclear power was even a net energy gain. Given the energy I know it will take to clean up Three Mile Island's little mess, I cannot believe, deep down, that the net energy problem can be all that easily posited.

As a first step in the debate, if we could pull ourselves together to start afresh, one could do a great deal worse than to consult a book, recently published by Macmillan, called *Nuclear Power: From Physics to Politics* by Laurence Pringle. It is a book written for children. And isn't it time that we all realized that we need to get the elementary facts down? They are in this book.

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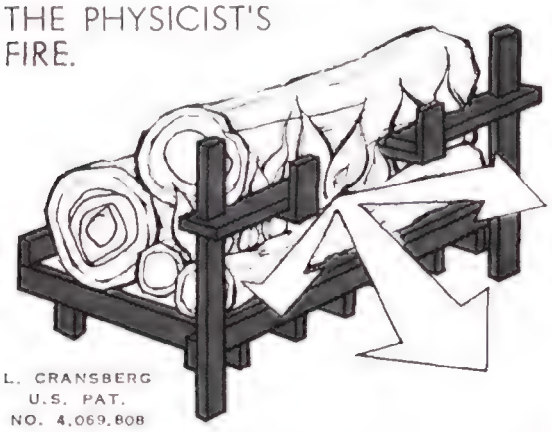

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Then you move on to *The Bulletin of the Atomic Scientists* put out in behalf, as it were, of those folks who gave us the insights scientifically to bring us to the particular precipice we now stare over the side of.

In a recent issue (Vol. 35, No. 8) there is an article by a former naval nuclear engineer who subsequently, for reasons that were presumably technical and professional, joined forces with Ralph Nader to assess the nuclear industry's safety. An important semantic distinction he makes (and one doesn't usually expect such from engineers) is that nuclear "waste 'disposal' is a *misnomer.*" You don't dispose of nuclear waste. You run desperately from governor to governor, looking for one politically suicidal enough to offer some of his or her real estate to house, contain and manage some lethally poisonous material that will remain just exactly that long after the governor's future family tree contains at least 25 begats. The upshot of the article is that we still don't really know where—or how—we will store the stuff.

Happy New Decade.

A modest proposal

We come then, in the very same issue of *The Bulletin,* to a discussion of how to live in a technological society by Harrison Brown of the East-West Center in Honolulu, long a commentator on science, technology and society. He begins with the insight that, in terms of resources, the United States is fundamentally self-sufficient, but—oil being here and there but not everywhere, and croplands the same, and so forth—if we were 50 nations we'd have a lot of trouble allocating resources. By which I guess he means a lot more trouble.

Among the familiar and terrifying list of problems we face globally, he makes two very striking points. One is that the Soviet Union has more resources, such as oil and coal, than we do.

The other point is that democracy has disappeared, to all intents and purposes, from the developing world and we advanced technological countries are split between a totalitarian bloc (or blocs) and the industrial democracies of the West. The West, by the way, includes that part of the East called Japan.

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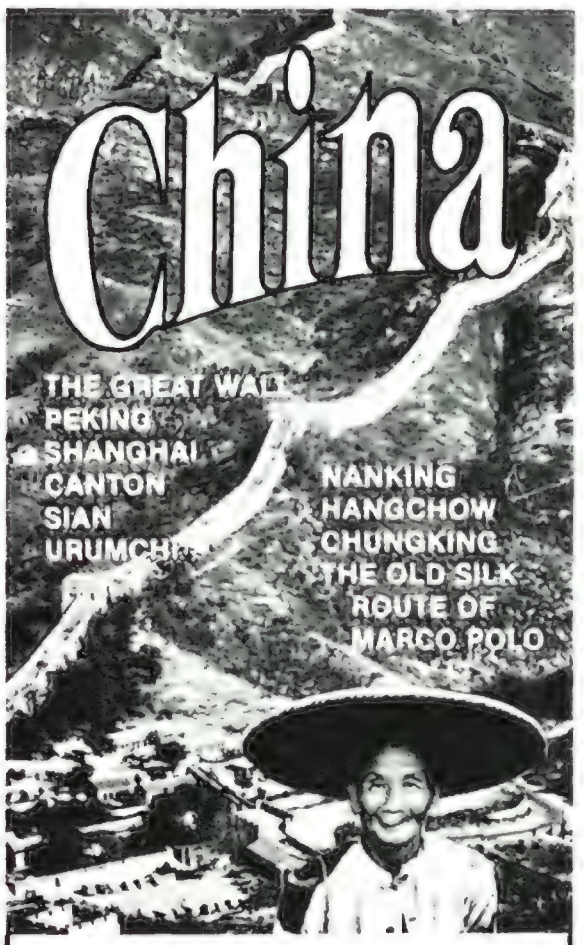

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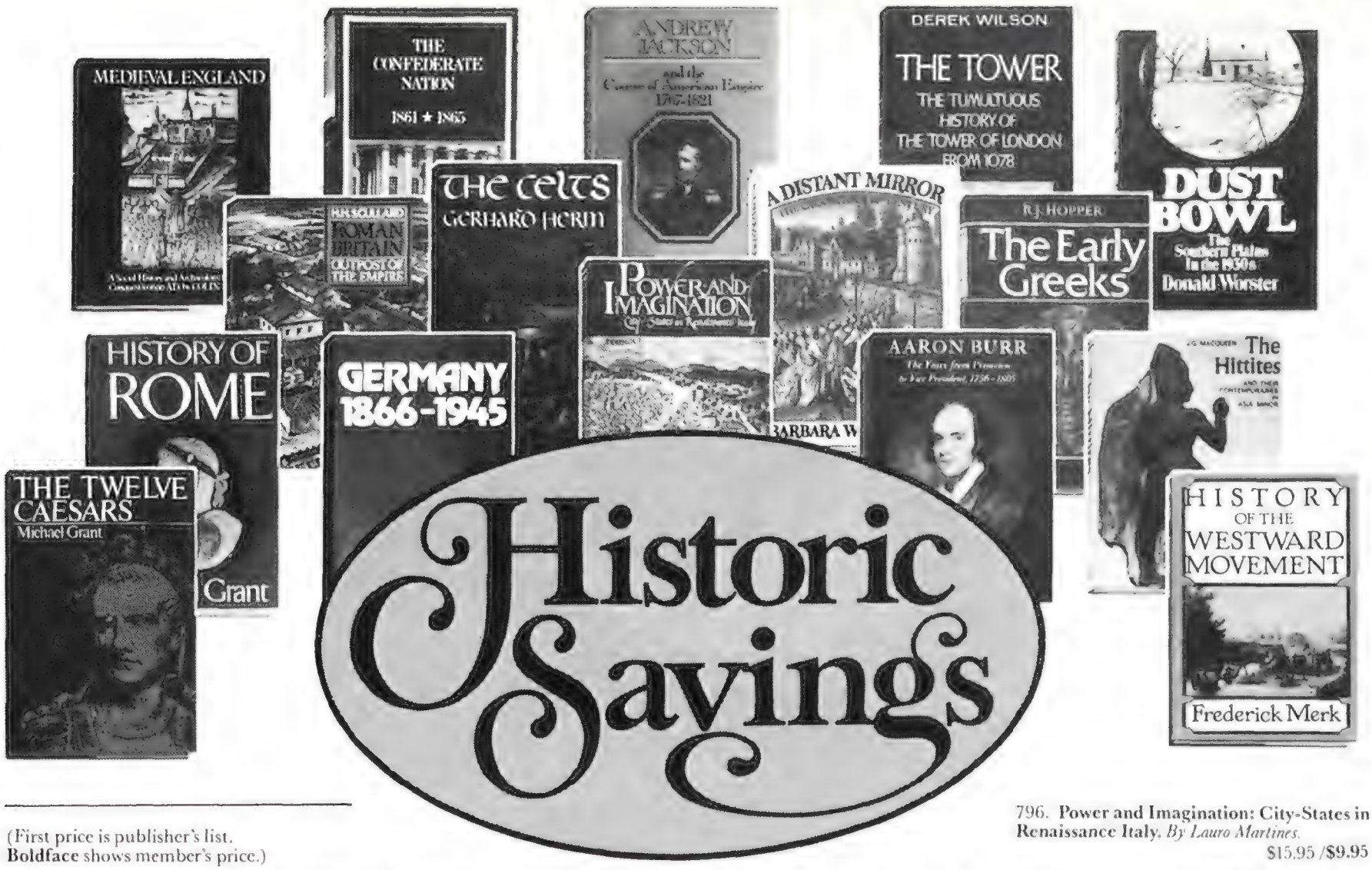

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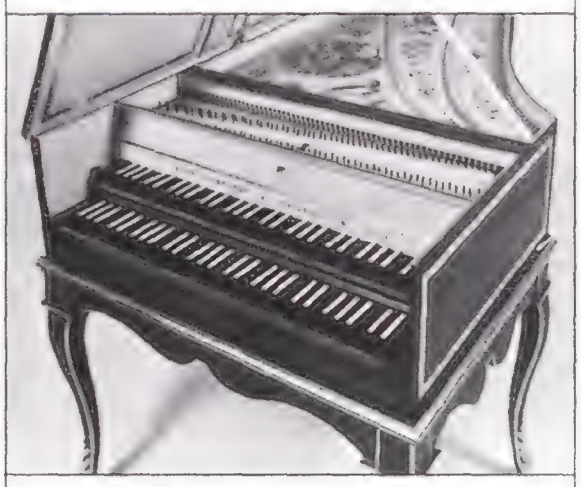

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nomic mountains we stand on, Brown says maybe the technological democracies could get up the nerve to promote joint policies—to act at least as well as the 50 United States—to have a single front to show the rest of the world. It wouldn't, he says, be one world, but it would be a start.

Happy New Decade.

A new controversy

Well, enough of that. There are matters that are of ultimately longer-term concern than the fates of nations and electric utilities and whatever systems of beads and shells they use to determine their value. There are matters of life—how it works and what it means—and the recognition that no one uninterested in life's intricacies and delights will ever solve the resource crisis or any other.

Some birds have bright colors. Others have dull colors. Darwin said that polygamous males would gain advantage by brightness, attracting more females. Monogamous birds can be dull colored. Females, because they're supposed to remain calm and hide on the nest, can generally be dull colored regardless of their faithfulness. It all seems reasonable enough, even satisfying.

But along came Robin Baker and Geoff Parker of the Universities of Manchester and Liverpool with a new theory of the evolution of bird coloration. (Both cities would seem the sort of place to engender an interest in brightly colored birds.) They say that the bright color of some birds is an advertisement not to the females, but to potential predators. The bright color says, "Don't bother to chase me, I'm too good at avoiding predators for you to waste the energy making a try."

According to *New Scientist* (Vol 84, No. 1176), the researchers found that in 516 species studied, the tendency was for "immobile birds to be cryptic, and mobile birds to be conspicuous."

Having recently lost a very bright-colored bird to a rather sedentary turtle, I'm not sure that I can go along with Messrs. Baker and Parker, and I am cheered that while the acid rain falls, *New Scientist* sees that a brisk controversy over bird coloration can, along with all the other dreary, earnest and crucial political hassles, be expected.

Happy New Decade!

—JAMES K. PAGE JR.

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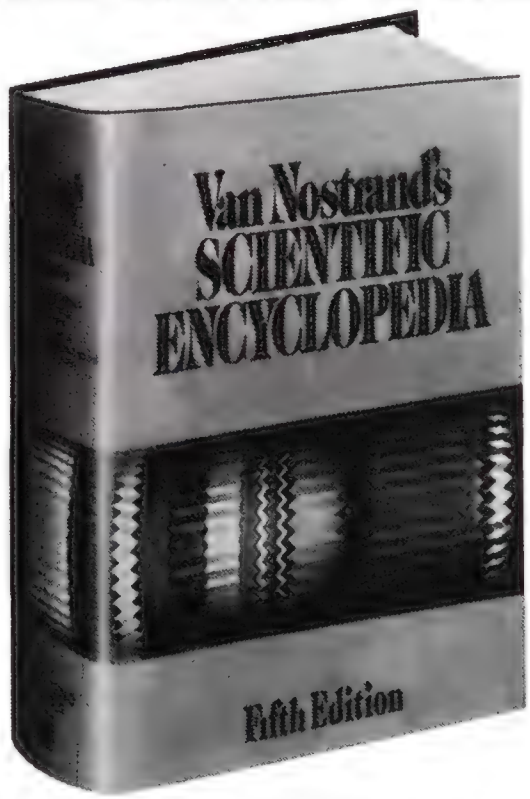

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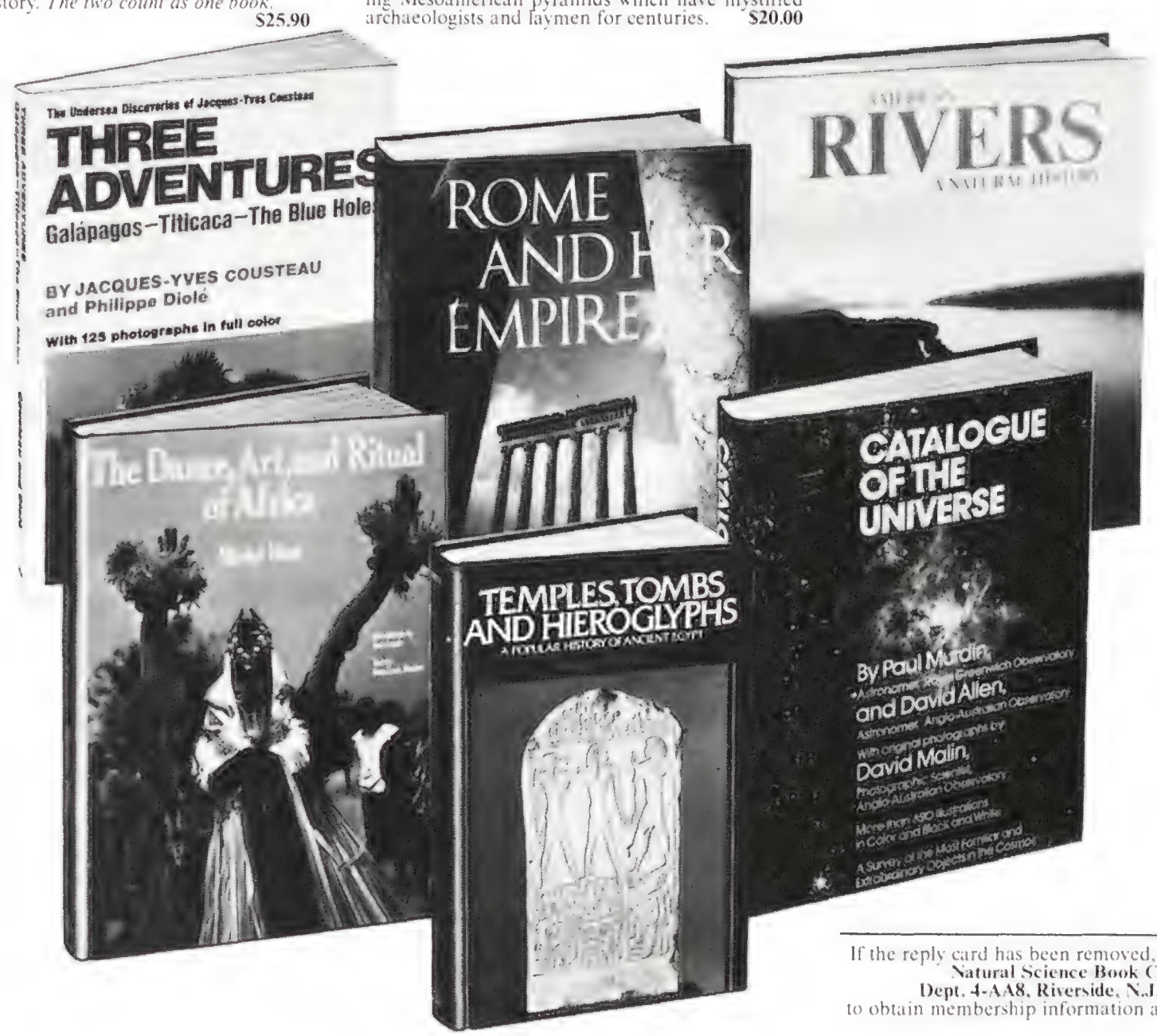

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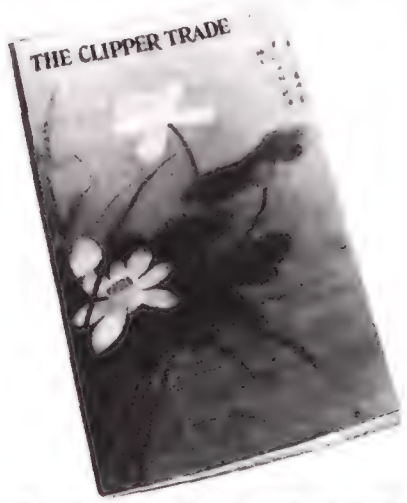

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Around the Mall and beyond

Fifty years ago, most of us were broke, as we are reminded by the exhibit "The Great Crash" at the National Portrait Gallery (SMITHSONIAN, October 1979). It recaptures, in cartoons and portraits and other subtle ways, the mood of the late 1920s, when the stock market inflated like a party balloon and then, on Black Thursday, started to fizzle away.

The rise and fall of the market are depicted here with glimpses of the days of heedless affluence, then the drama of the crash and the hopeless attempts by some financiers to rescue the situation.

Songs of the day echo through the exhibit, as they so often do in this marvelous museum. I remember *Keep Your Sunny Side Up,* particularly as the theme song of a morning wake-up show in Boston. But I can also remember it, faintly, in its original context—the late Twenties, when, in view of the Crash, it evoked a strange feeling which, I was then told, was called irony. You'll hear it again at this exhibit—a gentle warning to all of you high rollers out there.

"The Great Crash" continues until April 20. Right next door, in the National Collection of Fine Arts, a number of new art shows are scheduled, among them an exhibit of bird art. No, not art *by* the birds, nor *for* the birds (God forbid), but *about* birds. It's the kind of art that goes into your field guide by Roger Tory Peterson, and he, of course, is one of those represented.

Bird art, almost uniquely, combines art with scientific accuracy, and these paintings and drawings and wood carvings will hew to that line. The show is supposed to open at the beginning of next month and continue until May. By then the real birds will be back to delight us. Some of them generally drop in for a moment on or about the Mall, just to take over for a little while from those damn pigeons which have had the area to themselves all winter. Except for seagulls sometimes. And joggers.

The National Air and Space Museum has a lot of good stuff on deck for the 1980s. First, Claudia Oakes is producing a spring exhibit on early flight with beautifully restored planes right out of the days when the pilot sat out in the breeze with his golf cap turned around. There will be a Rinek Voisin of 1908, the Wright two-seater Military Flyer of 1909—the first military plane in the world—and the 1911 Curtiss Pusher that used to hang in the Arts and Industries Building before the new museum was built.

I always loved that Curtiss because it looked like such good fun to sit up there and chug along a few feet off the ground. But, also, I was always mystified by the oil leak in the Wright Military Flyer. There, under one of the two propellers, was a stain in the fabric wing. And on the museum floor, beneath that stain, I have found a small drop of oil.

That plane was turned over to us years ago, thoroughly restored, cleaned out, refurbished, petted, loved, admired—and it *still has an oil leak*!

You can't tell me that it's just the way old engines are. That plane was being started up, every midnight, where it hung from the ceiling. And now it's coming back on display. We'll see what happens.

The prettiest plane in the new exhibit, to me, is the early Blériot, a somewhat refined version of the craft that first flew the English Channel in 1909. It's a superb restoration, wings shimmering with tightly stretched fabric, engine spotless, woodwork gleaming with varnish. It looks as though it needs to be flown. We'll have to check that one out at midnight, too.

I saw the Blériot at our restoration and storage facility at Silver Hill, just outside Washington. I had visited there not just to go through the little museum which has been set up for specially arranged tours, but to check up on a small switching locomotive which was recently given to the Smithsonian by the Potomac Electric Power Company. It had been used to shunt coal cars around at a generating plant and has been replaced by a newer model—larger and more powerful.

The interesting thing about this little 35-tonner is that it cannot make its own steam. Instead, it used to huff into the generating station, get its round little boiler (really just a tank) charged with steam and then puff out again, all set for four hours of work. It was called, naturally, a thermos-bottle locomotive, and the Smithsonian is happy to have it because there aren't many like it around. Pepco donated it as a sort of nod toward the 100th anniversary of Thomas Edison's invention of the incandescent light bulb. One of the features of our own celebration of that anniversary (SMITHSONIAN, September 1979) is a Monopoly-like game called Bright Ideas designed by Marjorie Share, Deborah Dawson and Dennis Gould, all of the Smithsonian Institution Traveling Exhibition Service. Throwing the die gets you started on the road to the invention of the lamp. But cards may send you back to the old lab or give you a patent. A good, suitably frustrating, informative family game. Great fun.

While at Silver Hill I made an appointment to meet John Stine and see the engine of the ore ship, *Indiana*. The story of salvaging that 122-year-old chunk of machinery made a lot of papers last summer. Since it's destined to be a major exhibit in the 1980s, I wanted to see it.

John Stine, director of the salvage operation, emphasizes that the engine represents two distinctly new features for the Institution. First, it's the earliest steam power plant that actually worked still extant on this continent. Second, the job of hauling it up from where it lay, about 120 feet down in Lake Superior, is the first bit of freshwater archaeology the Smithsonian has ever tried. The Institution has made use, of course, of many underwater finds, but we'd never before carried out this big an operation.

There are two other factors which make *Indiana's* power plant extraordinary. Bob Post, former curator of our Maritime Hall, explains that the engine was only ten years old when the vessel went down. "No one had a chance to tinker with it," he says, "the way our earliest locomotive, 'John Bull,' was tinkered with. Every bit of this one is authentic for 1848, when the ship was built. Even the petcocks were in place. And when you wiped away the scum and smoothed off the little blisters of oxidation, you found real iron and brass, almost usable."

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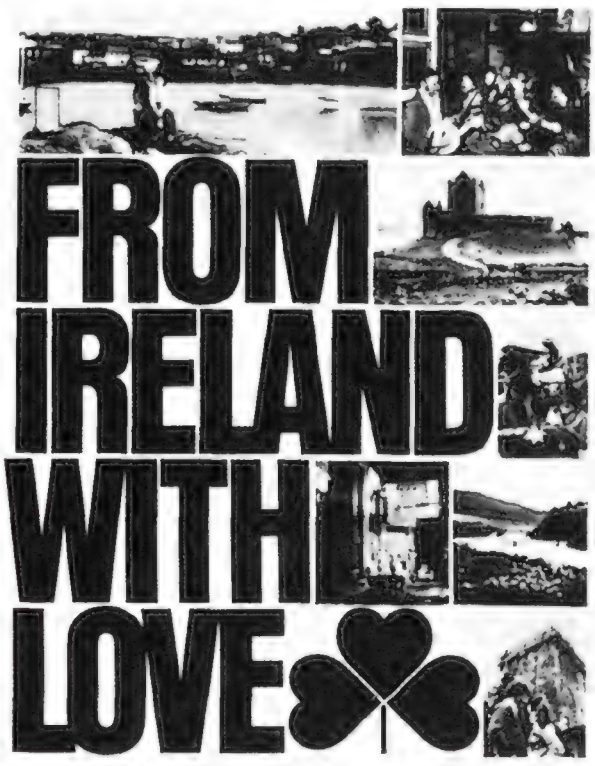

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The reason for such good preservation was that *Indiana* sank in cold, fresh water. It faced no irresponsible little marine growths, as it would have in a salubrious tropical sea. It just sat there on the lake bottom, 120 feet down, some five miles from the Michigan shore, waiting to be discovered.

That finally happened in 1975 when a group of historian-scuba divers picked up the presence of the vessel and identified it. A Navy Harbor Clearance Unit from Little Creek, Virginia, was brought in. They got on the job, with help from a Chicago Naval Reserve unit doing a summer tour of duty, and eventually up came the entire propulsion system. Stine and Post agree that for the Institution it was a highly satisfactory introduction to freshwater archaeology. It was also a curiously demanding operation because the divers had to act as long arms for the experts on the deck of the diving barge. "We would explain how various parts of the machinery ought to come loose," Bob Post said, "and they'd try to put theory into practice. Sometimes it isn't easy."

Other times it worked like a charm. "We described four bolts that should be holding down one end of the drive shaft," John Stine told me. "The divers not only found them, but were able to loosen two of them by hand."

And again, in removing the rudder, Stine told the underwater crew that it should have a shackle built into it that might help them. "It did," he said.

Indiana's bent rudder, up from the depths.

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"There it is." We were standing beside the great, rust-orange chunks of metal. The shackle was there, on the bent, punctured rudder. The four-bladed propeller lay beside it, one blade broken off. The huge boiler is barely dented. Copper pipes for intake and exhaust look as though they could be used again. And amid the steam machinery is a hand pump that is no different from the bilge pumps found today on any traditionally designed sailboat. I recognized it and could hardly believe that the design had not changed since 1848, when *Indiana* was built.

From the evidence that was raised out of Lake Superior, the story of the vessel's sinking becomes pretty clear. On a June day in 1853 she was carrying ore from Marquette, Michigan, toward the three-year-old Soo Canal. She threw a propeller blade which struck and punctured the rudder, jamming the steering mechanism. The unbalanced turn of the propeller shaft broke the stuffing box through which the shaft enters the hull of a ship. Water came in fast. The crew went below to make repairs, but the ore cargo was in the way. They could not shift it in time to seal off the rupture, and the pump, meanwhile, couldn't keep up with the leak.

John Stine, director of operation, tries firebox door of boiler.

In about 15 minutes, on a nice calm day, *Indiana* went under. Her crew got off safely and rowed ashore. When the vessel struck bottom, her rudder was bent. Everything else remained in pretty good shape. She had circled, after throwing that propeller blade, and sank close enough to it so the divers found that, too.

Considering how easily *Indiana* slipped under, the salvage of her engine was difficult and complex. The divers brought their gear to an Army Corps of Engineers barge which carried a derrick. This floating dive platform was then towed to the site, which was marked by buoys. The divers suited up, adding about 150 pounds of equipment. Each man stayed down about half an hour, then took another half-hour to come up.

Indiana's engine will go on display early in the 1980s at the Museum of History and Technology. A large and important display for us all to anticipate.

—Edwards Park

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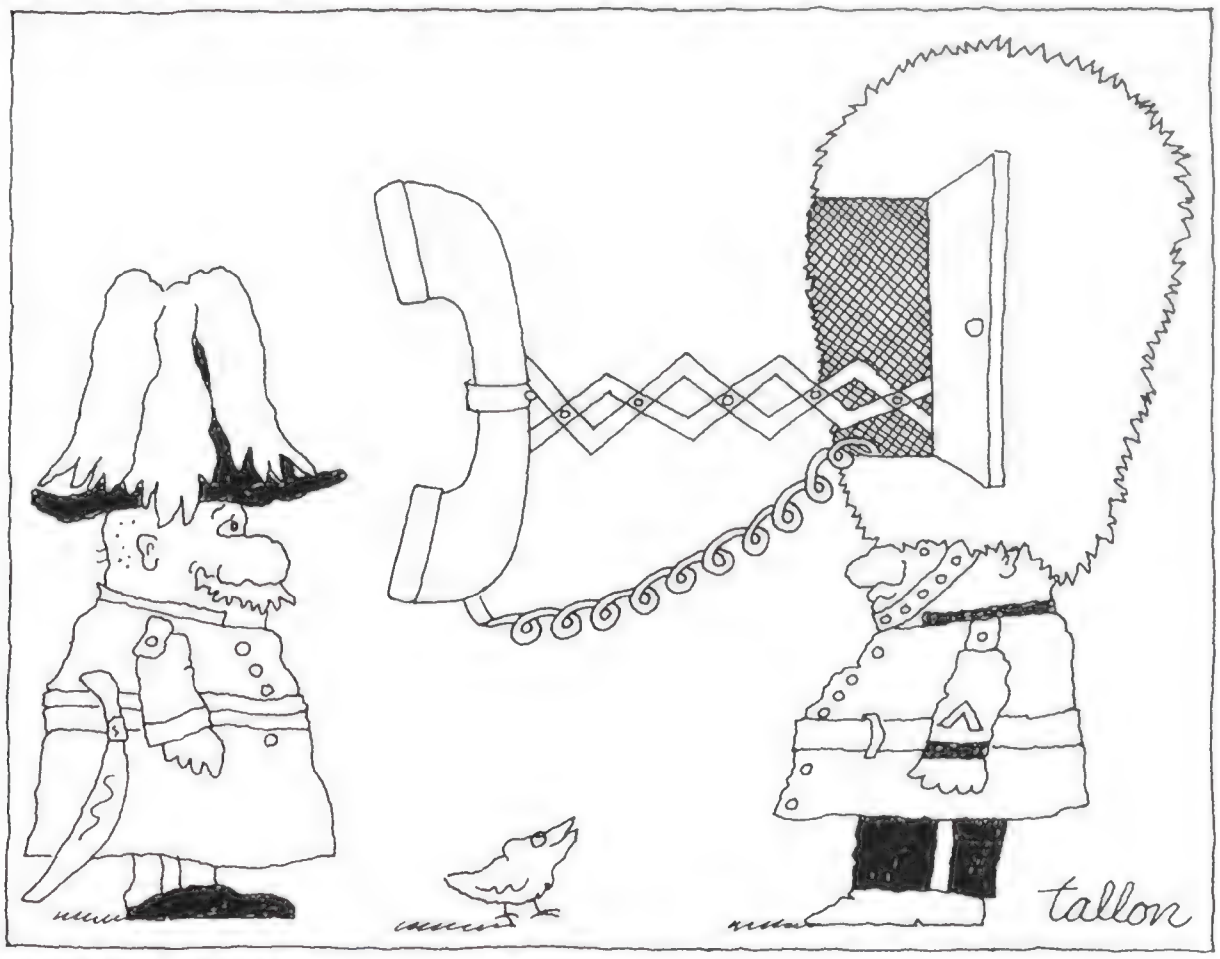

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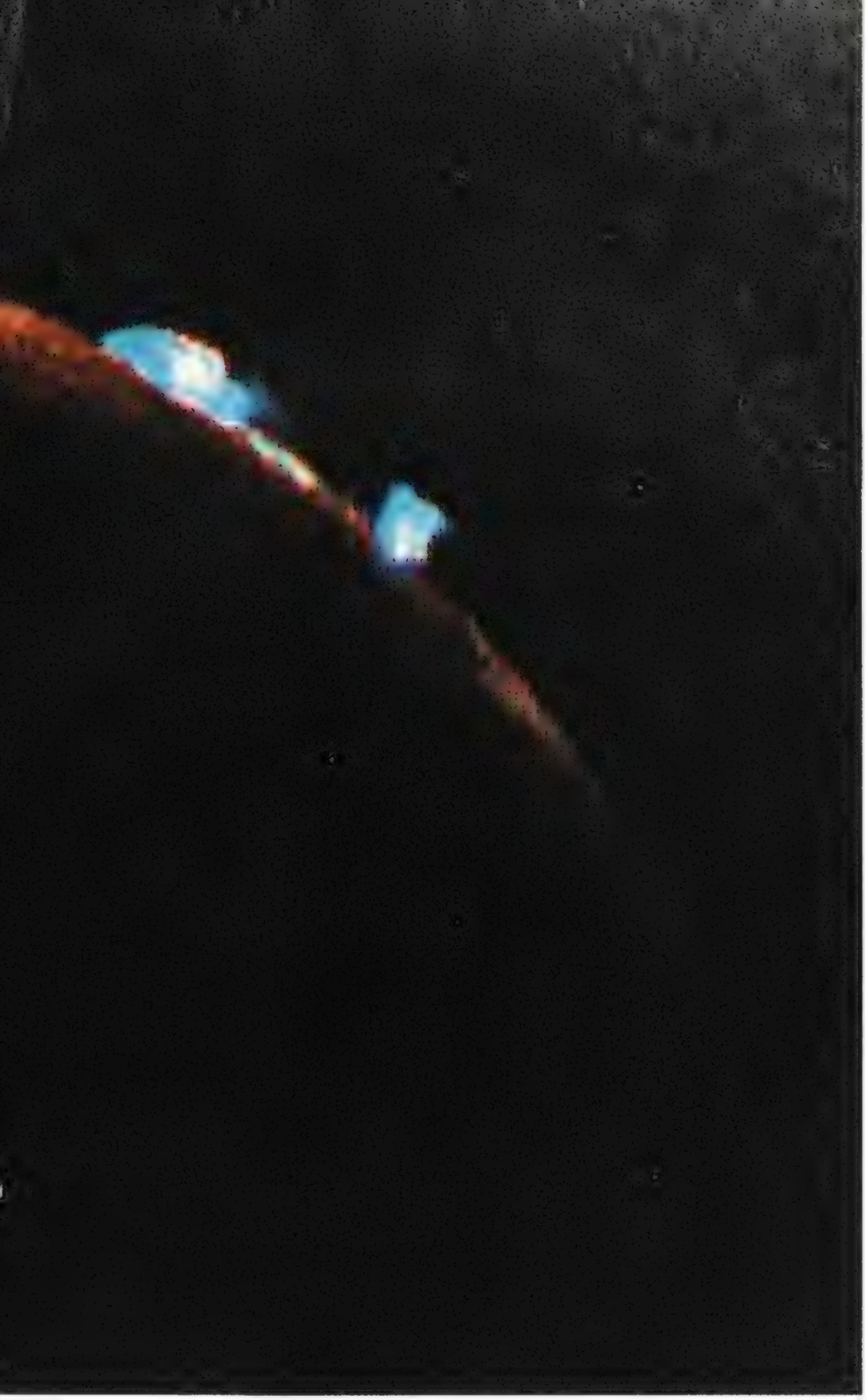
Bell System

By William K. Hartmann

Moons of the outer solar system become real, although weird, places

Detailed photographs of planet satellites show them cratered, fractured and volcanic; next we will see one with an atmosphere

The author is a planetary scientist in Tucson. He last wrote for SMITHSONIAN *(September 1975) on the causes of past climate variations on Mars.*



The four large moons of Jupiter (clockwise from upper left)—Io, Europa, Callisto and Ganymede—are shown here to scale with natural colors, nearly relative brightnesses.

Volcanoes flare on the edge of the moon Io (see cover) in July. The color of the plumes probably results from the scattering of sunlight, the cause of our blue skies here.

The year 1979 was one of extraordinary and underappreciated planetary exploration. Eleven years had gone by as we got close-up pictures of the worlds in the inner solar system, from the first detailed lunar photos in 1964, revealing a dusty world blasted by meteorites, to the first surface photos of boulder-strewn Venus in 1975. But in only two days in early March 1979, we added to our gallery shots of four new planet-class bodies: Callisto, Ganymede, Europa and Io. They are the four large satellites of Jupiter, discovered in 1610 by Galileo Galilei and Simon Marius, worlds ranging roughly from the size of our moon to the size of the planet Mercury. For the last 370 years they have been mere points of light in astronomers' telescopes but now, in the pictures sent back across interplanetary space by Voyager 1, they have become real places, each with its own weird landscape:

- Callisto, the outermost Galilean moon, heavily cratered and covered with a layer of dark soil, dotted with bright areas where impacts have exposed the bright ice underneath;
- Ganymede, the largest and next inner moon, with some Callistolike cratered patches but also grooved areas of mysterious geological activity;
- Europa, an unprecedented icy billiard ball, broken by a network of fractures hundreds of miles long;
- and Io, innermost of the four Galilean moons and most bizarre of all. Out of its mottled orange-and-white sulfurous surface, the first active extraterrestrial volcanoes discovered in the solar system shoot bluish plumes of debris more than a hundred miles into space.

Voyager 1 did not only reveal the features of the Galilean moons. It also photographed the tiny moonlet Amalthea, a cosmic potato just 90 miles high and 165 miles long, and discovered the millions of tiny "moons" that make up hitherto unseen rings around Jupiter, now the third planet known to have them.

There was more. Voyager 2 flew through the Jovian

Photographs from JPL/NASA

Low sun highlights the contorted topography of the fracture system on Ganymede in this close-up view.

system in early July, adding new views and showing the changed pattern of volcanic eruptions on Io. On July 20 we celebrated the tenth anniversary of our first landing on our own moon. And in September lonely Pioneer 11, which had flown by Jupiter in 1974, finally reached Saturn and sent back not only new views of those rings but a blurry vision of Titan, the solar system's only moon with a dense atmosphere (p. 47). This disk appears nearly featureless, confirming Earth-based evidence that Titan is covered by clouds.

All this happened, it seemed to me, with inadequate fanfare. Here a spacecraft was sending back pictures, broken down into numbers for transmission and then reconstructed on their arrival on Earth. Television stations were invited to use the pictures as rapidly as they appeared on the screens of the Jet Propulsion Laboratory in Pasadena—essentially what broadcast people call a live feed—but few stations bothered to carry them. It was as if Renaissance television networks passed up their chance to carry live pictures from the Santa Maria in 1492.

During the second Voyager flight among the alien craters, plains and volcanoes in July, the news media riveted their attention not on Jupiter's satellites but on an artificial satellite, Skylab. Skylab's fall during the week of the Voyager 2 flyby was a serious event, but most news accounts failed to mention that natural meteorites the size of Skylab's components hit the Earth every few years. Skylab showed not only that anthropocentricism is still with us centuries after the Copernican revolution ("I am worried that a truck-sized object dropped at random on the Earth is going to hit me"), but it also blanked out the excitement of Voyager 2's exceptional discoveries.

Front-page news or not, we now have color pictures and memory banks full of data on these new worlds. We can study their environments, identify resources we may be able to use in the future when we arrive in person, and better answer the ultimate questions of how our worlds came to be and how they evolved. All of this comes, of course, on top of the simple thrill of discovery.

Until now, Earth was the only place we could study a living planet, one where the surface is still being worked by a seething interior. And scientists tend to be uncomfortable with a sample of one. Suddenly, we have more and the rush is on to see how such awesome forces work on other bodies.

One unifying concept is emerging as a key to understanding planets with solid surfaces, like the Earth. A planet's landscape is largely determined by the nature of a relatively rigid and solid outer layer known as a lithosphere. Below this lithosphere is usually a hotter, amorphous layer, which may be partially or completely melted, called an asthenosphere. The origin of these two layers is easily understood. Planets usually have sufficient radioactivity to have caused their interiors to heat up and melt. The surface layers cool off rapidly because they are exposed to space and radiate their heat into the black night around them. Hence, the

Some older ridges appear to be cut by younger ones. Smallest features visible are less than two miles across.

The new impact crater at bottom of picture has thrown fresh material on dark surface of Ganymede.

outermost surface layers crystallize into a solid lithosphere, while the deep layers remain partly melted.

A revolution shook the geological sciences about ten years ago with the culmination of years of controversy about continental drift on Earth. What emerged was the theory of plate tectonics: Earth not only has a relatively thin lithosphere (45 to 60 miles deep), but it also has an active asthenosphere which has split the lithosphere into a number of distinct plates. These are pushed about as they float on the asthenosphere, sometimes separating, sometimes colliding with each other (SMITHSONIAN, January and February 1975).

Precisely because Earth has a thin lithosphere and active asthenosphere, its surface is young and constantly changing; its ceaseless churning has erased many of the large impact craters that have accumulated on other planets.

At the other extreme is our moon. The lunar surface still carries the scars, long since obliterated on Earth, of the bombardment by meteorites, miles across, that went on during the first half billion years of the solar system. The lunar surface also indicates that in its first 100 million years or so, the moon was covered by a vast ocean of molten magma that rapidly solidified. As this lithosphere formed, it was scarred by the impacts of the giant meteorites, forming the moon's familiar craters. The seismographs left behind by the Apollo astronauts recorded a zone of "moonquakes" about 600 miles down in the moon. This is interpreted as the base of the lunar lithosphere today, 4.5 billion years after the moon formed. So the moon has a dormant, solid lithosphere, active only at its base where some stresses may be built up by a more fluid asthenosphere material. The great thickness of this solid layer explains why the moon's surface has not been broken into plates and is not mobile and does not have ongoing volcanic eruptions or mountain-building activities.

Generalizing as to other planets, we can say a dense crowding of impact craters suggests that a planet's surface has been dormant for at least 3.5 or 4 billion years and, therefore, the lithosphere is thick and unbroken. This applies to the moon, Callisto and most of Mercury. Fault scarps, fracture patterns and so on, such as we see on Mars, Ganymede and Europa, suggest a thinner lithosphere. Active volcanoes, as on Earth and Io, indicate a still thinner lithosphere.

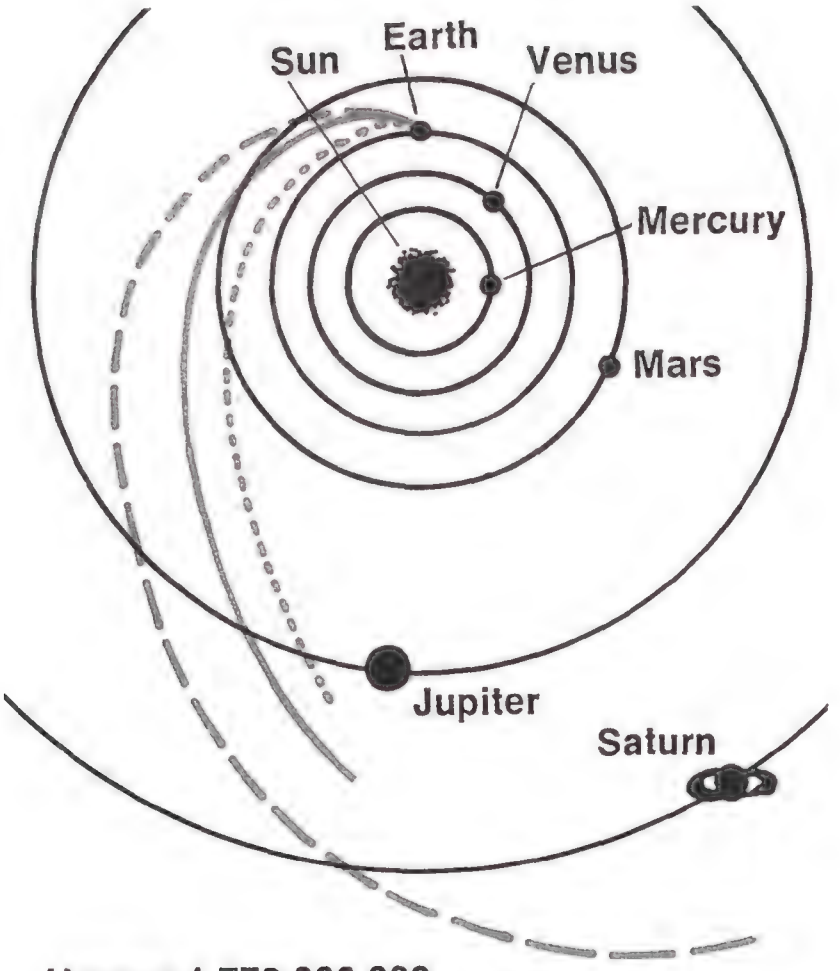


Diagram shows progress of spacecraft to Jupiter and Saturn (Voyagers solid line, short dashes; Pioneer long dashes). Distances from sun to outer planets in miles.

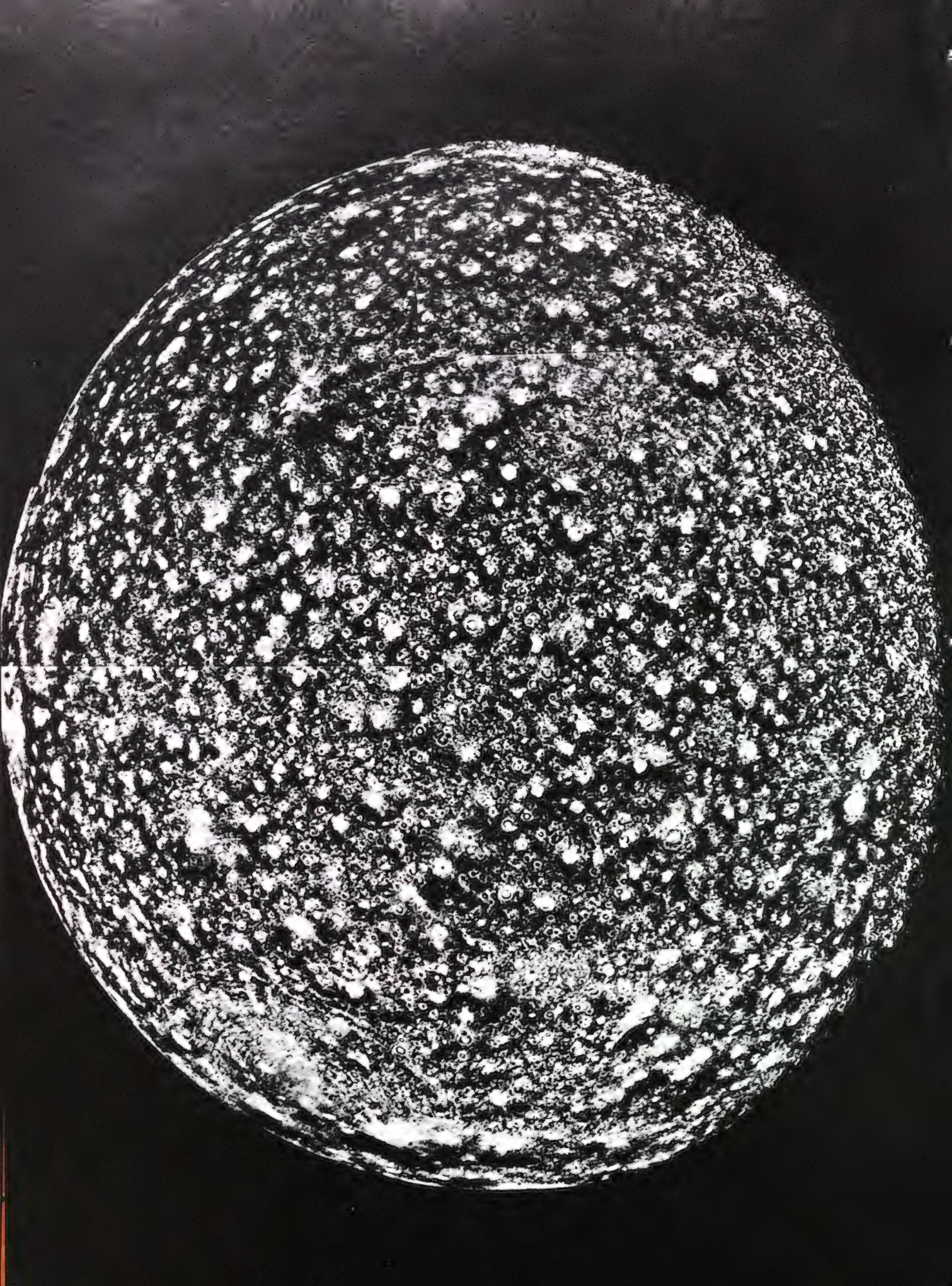
Prior to 1979, these ideas could be tested in the inner solar system only. Because the outer planets, the gas giants, don't have anything like lithospheres, scientists spent much effort estimating what the planet-sized moons of the outer solar system might tell us. Only a few years ago, they were virtually unknown and seemed unknowable. The astronomer's usual ferret, the spectrograph, produced only a few clues from the sunlight reflected by them. In 1944, the Dutch-American astronomer Gerard Kuiper, using infrared detectors, showed that Titan has an atmosphere. But the rest of the satellites remained unremarkable star-like dots. A 1958 compendium on Jupiter by the aptly named British visual observer, B. M. Peek, devoted only a few pages to the satellites, though noting that "light and dusky markings" must exist on them and that they kept the same faces toward Jupiter.

The relatively low density of these moons indicated that though they might contain some rock, they also had to have some material of lower density than rock. This was generally assumed to be some kind of ice, such as frozen water or methane, because such materials were common in the early solar system and the sunlight reaching the outer solar system was too weak to burn away ices of these abundant compounds. Thus, while the inner solar system features rocky planets, the outer features icy ones. Sure enough, in the mid-1950s and early 1960s, Kuiper and the Russian astronomer V. I. Moroz applied better infrared equipment and discerned features that indicated ice or frost on Europa and Ganymede.

In 1964, the innermost of the four Galilean moons, Io, began to stand out from the rest. Radio astronomers discovered that at certain frequencies Jupiter's radio noise occurred at times when Io was in certain positions in its orbit as *seen from Earth*. Within a couple of years analysts deduced that Jupiter's strong magnetic field, in which the natural radio signals originate, extends out as far as Io and interacts with that satellite. This causes beams of radio noise to shoot out in certain directions. The revolution of Io around Jupiter acts something like the rotation of a searchlight, causing the beam to sweep Earth and to produce such intermittent radio bursts when Io reaches various positions.

A second peculiar observation of Io was published in 1964. Two of Kuiper's graduate students, Alan Binder and Dale Cruikshank, had the unusual idea of looking for thin atmospheres on Galilean satellites by studying their brightnesses as they passed into and out of Jupiter's shadow. They reasoned that the strong temperature drop as the satellites went through the shadow might cause condensation of clouds or frost, so the satellites would be brighter when they emerged from eclipse. Callisto, Ganymede and Europa showed no substantial effect. But several times they watched Io disappear into the shadow normally, then emerge 5 to 12 percent brighter, only to fade back to normal in about 15 minutes. This might have been firm evi-

Shattered surface of Europa shows almost no craters, suggesting that it is younger than Callisto's and Ganymede's. Despite the cracks, it appears that moving plates did not form here as they did on the Earth.



dence for an atmosphere, except that other observers sought the effect with only mixed results. By the early 1970s, some of the Io eclipses had yielded reported brightenings, while others, observed with high precision, yielded no effect at all.

By 1973, the Pioneer 10 spacecraft established that Io does have a tenuous gas envelope with less than a millionth of Earth's surface pressure, but no atmosphere worthy of the name. The whole affair was temporarily relegated to the rapidly filling file drawer of Io anomalies.

While observers discovered peculiar phenomena, theorists also stayed busy. In 1971 American geochemist John Lewis made the first serious calculations of conditions inside the Galilean satellites. Lewis' basic model was that these satellites, having formed in the cold outer solar system, contained ices as well as some rocky material. Radioactivity melted them, and the denser material sank to form a central rocky core. A cold, thin "lithosphere" of ices would crystallize at the surface. This icy lithosphere floats on a deep asthenosphere of slush.

The density of the Galilean moons increases as we move inward toward Jupiter. During its formation Jupiter radiated considerable heat, forming a kind of weak mini-sun that burned away most of the ices from the inner satellites, just as the sun produced high-density planets in the inner solar system and less dense, icy planets in the outer solar system.

By 1973, improved infrared results supported this general picture. Frost or ice was firmly identified on Europa and Ganymede and weakly indicated on Callisto. Though Callisto has the most ice-rich interior, it apparently has the most soil mixed in its surface layer and the darkest surface of the four. Io, once again, was found to be different, with no surface ice or water in any identifiable form.

Still another Io anomaly appeared in 1972, when observer Robert Brown, then at Harvard, found a faint cloud of sodium atoms surrounding Io. These atoms are being knocked off the surface of Io by the high-energy particles that zip back and forth in Jupiter's magnetic field. Astronomers began to home in on the question of Io's surface. If it isn't ice, what is it? Scientists had long known that Io was reddish-yellow. In 1973 the Arizona observer R. B. Minton took particularly sharp photographs showing dark-reddish polar areas and yellowish-white equatorial regions. These colors suggest sulfur compounds. By the following year, geochemist Fraser Fanale and his associates at Caltech's Jet Propulsion Laboratory speculated that if Io had been strongly heated, the water would have been driven to the surface and evaporated into space, leaving surface deposits like those in the ancient lakebed salt flats of Earth. In particular, they postulated the presence of both sulfur and sodium-rich compounds such as salt.

Tiny Amalthea, about 90 miles high by 165 miles long, circles Jupiter well inside the orbit of Io.

This mosaic of nine picture frames, taken with filters to provide high contrast, reveals Callisto as the most heavily cratered body in the Galilean system. The relief is low, as much of this moon is made of ice.

But why is Io's water loss so efficient? During 1978 dynamicist S. J. Peale and two colleagues studied the tidal forces exerted by Jupiter on Io and the other satellites. The tidal forces actually stretch the satellites; Jupiter's gravitational field pulls hardest on the satellite closest to it. As such a moon moves around Jupiter, its eccentric orbit carries it closer and then farther away so that these tidal forces are constantly changing. The resulting flexing is always much stronger on the closest satellite, and Peale concluded that it would be strong enough not only to melt Io, but to keep its interior intensely hot. With admirable nerve, Peale's group published their conclusion that Io might display "widespread and recurrent surface volcanism" in the March 2, 1979, issue of *Science*, which appeared during the very week that Voyager 1 sailed into the Jupiter system.

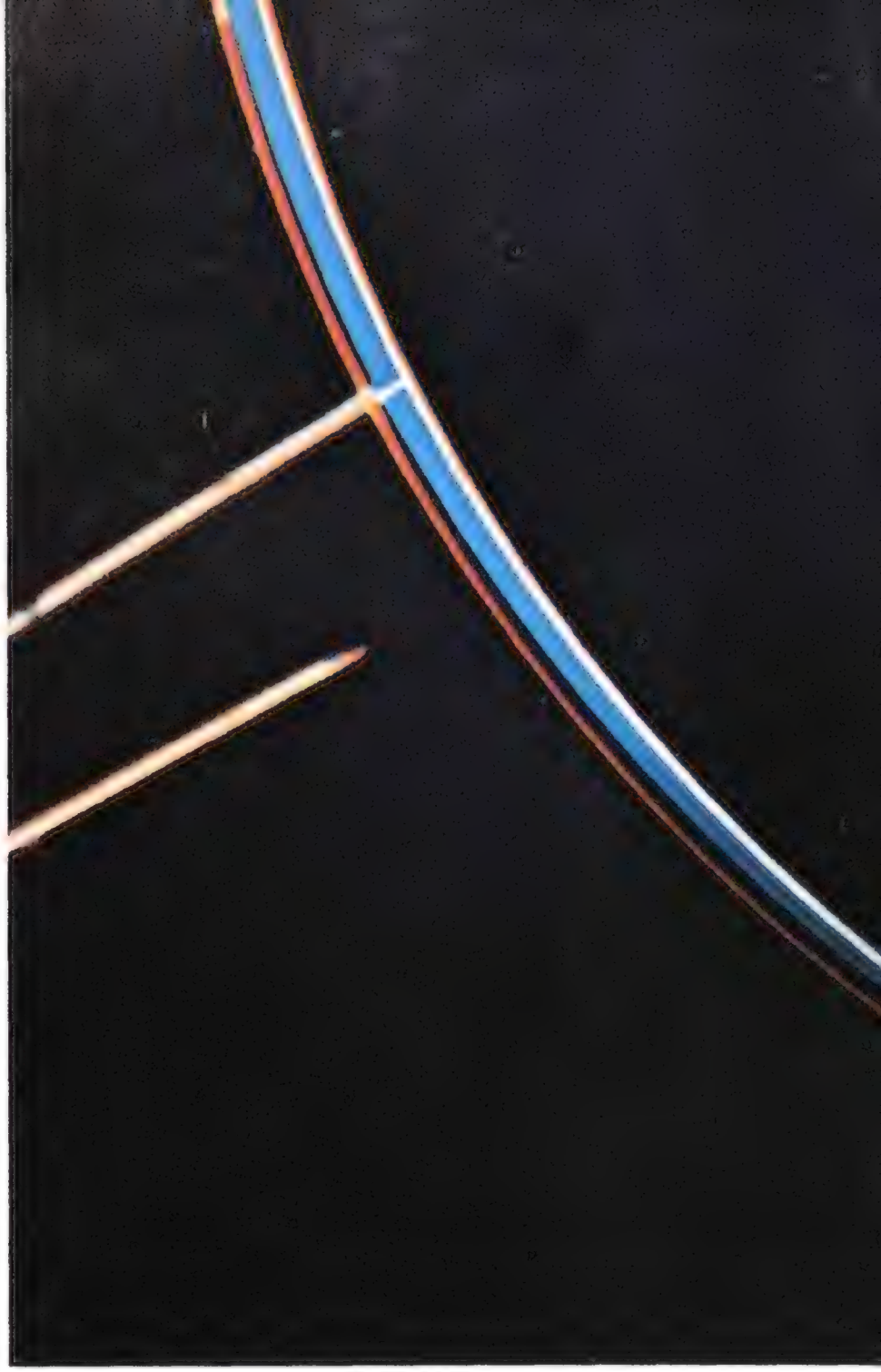
After its 18-month trip across some 625 million miles of interplanetary space (not to mention our 370-year wait), Voyager gave us our first look at these new moons. The outermost, Callisto, is an old, battered world with many impact craters. The preservation of so many craters means that Callisto's lithosphere has

long been dormant. Probably it is thick and, thus, not broken by volcanism and plate-tectonic motion. As early as 1972, planetary astronomer T. V. Johnson and geologist T. R. McGetchin pointed out that glacierlike ice flow on these satellites would probably reduce topographic relief. Indeed, old Callisto craters that were initially as much as a mile deep seem to have flattened out, producing ghostlike ring systems. The dark surface suggests that dirt has been left behind as ice slowly vaporized into space during Callisto's long history. Brilliant aureoles around some of the fresher craters may be impacts that blew away the soil cover and exposed fresh ice. Callisto apparently never mustered enough geological strength to break its lithosphere or obliterate the ancient impact craters.

The next moon in has been more active. Ganymede looks at first most like our own moon, with large dark patches. But these dark areas are not the younger plains, as on our moon. Rather, they are patches of ancient Callisto-like cratered crust, broken by strange bright bands of grooves. The grooves are the younger regions, unlike any large-scale planetary features seen before. They are typically hundreds of miles long. Individually, the grooves appear to be a few miles wide and only a few hundred yards deep.

Some planetary researchers speculate that bands of grooves mark "plates" formed by cracking of the ancient Callisto-like crust. Modest internal heating might have cracked the lithosphere but was inadequate to drive eruptions of water or lava that could resurface the planet. The grooves might be zones of fractures created when the "plates" jostled against one another as they floated on a slushy asthenosphere. Voyager scientists believe that any such activity occurred billions of years ago, judging from the impact craters accumulated in the grooved terrain.

Europa revealed a still different, but related, pic-



Bright bands at left are newly discovered rings around Jupiter, actually swarms of moonlets. Lower ring, closer to camera, appears to end in Jupiter's shadow. Sun is behind Jupiter; the rings are backlit.

In a picture taken from 12 million miles away, Io (left) floats in front of Jupiter's Great Red Spot while Europa is against a cloud layer. Io's surface colors it orange, with Europa's icy surface (center) white.

ture. From a distance, Europa shows not the plate pattern of Ganymede but a nearly featureless, bright disk. Closer inspection shows a relatively uncratered billiard ball, broken by an intricate pattern of fractures more than a thousand miles long. Detailed photos show apparent ridges of new ice squeezed up along the fractures. The surface, with its comparative lack of craters, indicates that Europa's original crust has been resurfaced sometime in the past, but the age and the mechanism are unclear.

Some tidal heating, predicted by Peale's group, may have produced a world with a single lithospheric plate broken by fractures where hot springs of "molten" water occasionally erupted onto the surface. These ideas could explain the high concentration of surface ice and raise the question of whether Europa experiences occasional geyserlike outbursts even today.

Interestingly, the closest terrestrial analogue to the surfaces of Ganymede and Europa are the ice packs of the Arctic Ocean, where thin lithosphere-like ice floats on asthenosphere-like water. High altitude photos of these areas show patterns of fractures resembling those on Ganymede and Europa.

Io, the wildest of them all

When the first photographs of Io came in, one Voyager team member quipped that it looked like the cheap mock-ups of planets that we used to laugh at when they appeared outside spaceship portholes in Grade B science-fiction movies. Patches of different colors alternated on the surface with dark spots and fuzzy patches. Chemical studies show that the colors come from sulfurous deposits, just as yellow and white sulfur mottles the eruptive areas of Yellowstone Park.

On Io, no impact craters could be seen, indicating that the surface was quite young. A few days later, Jet Propulsion Laboratory flight engineer Linda Morabito discovered an erupting volcano—an immense, fuzzy, umbrella-shaped plume rising 160 miles above the edge of the planet. Altogether, eight major erupting volcanoes were discovered, of which at least six were still erupting four months later when Voyager 2 flew by. In retrospect, an outburst may have been spotted a year earlier by NASA observer F. C. Witteborn and colleagues, who detected a strong, brief emission of heat from Io. In Hawaii, observer W. M. Sinton reported a similar outburst last June. These observations suggest that there may be occasional explosions of molten sulfur even more violent than the normal eruptions seen by the Voyagers.

Scientists are now thinking about a "double lithosphere" for Io. They envision a surface layer of sulfur compounds comprising a thin lithosphere floating on a molten sea, all of which rests on a deeper rock layer,

a true lithosphere that in turn floats on a molten silicate magma. The rock subsurface provides the strength to support the mountains seen on Io. The concept resembles Earth's Arctic surface ice floating on the polar ocean, which rests on a rocky sea floor, in turn resting on a partially molten mantle.

An observer on Io would confront a spectacle. The landscape would be dominated by brightly colored deposits and perhaps even flows of molten sulfur. From time to time enormous plumes would be shot out of volcanoes. And although the sky would normally be as black as the sky on our moon, the glow of sodium atoms would sometimes be visible as a ghostly aurora.

If the variety of these Jupiter satellites is not enough, we can turn for one last look at Saturn's large satellite, Titan. Titan has always interested armchair astronauts because its thick atmosphere implies a blue sky, and the thought of Saturn hanging in a blue sky over some strange landscape excited visual imaginations. Observations in the last few years, however, have shown that Titan has a fairly thick cover of reddish clouds. An observer on Titan might have to fly above the clouds to see Saturn at all. To reverse the problem, we probably cannot see below the clouds to determine what the surface of Titan is like. Because the methane-rich Titan atmosphere is something like that postulated for the early Earth and because we now recognize the possibility of hot-water asthenospheres, Titan might be one of the solar system's best prospects for warm springs where biological or prebiological chemical evolution might be occurring. All we can say is that cloud-top temperatures are well below minus 300 degrees F. These very cold values are consistent with Titan's enormous distance from the sun and were generally supported by measurements from Pioneer 11 as it flew by at some distance from Titan. To know whether hot springs exist, we'll have to wait at least until Voyager 1's Saturn flyby in November 1980.

Nonetheless, the large satellites of the outer solar system are dramatic worlds with unique landscapes. They may display various stages of plate tectonics and geologic activity. They have craters, soil, exotic chemical compounds, ice, erupting volcanoes and perhaps even hot and cold running water. The new discoveries promise better understanding of the workings of all planets, including our own Earth. And they have given us new Yellowstones, new Grand Canyons hundreds of millions of miles away.

Not long after Voyager 2 flew by Jupiter, the Pioneer 11 spacecraft made it to Saturn, nearly a billion miles from Earth. Spot of light bottom center is Rhea, sixth moon out from Saturn and half the size of ours.

Titan, a moon of Saturn larger than planet Mercury, is viewed from a distance of about 230,000 miles. Better pictures are expected from the Voyagers when they arrive in the vicinity of Saturn this year and next.

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By Dorothy Fields

'Holders of most important intangible cultural properties'

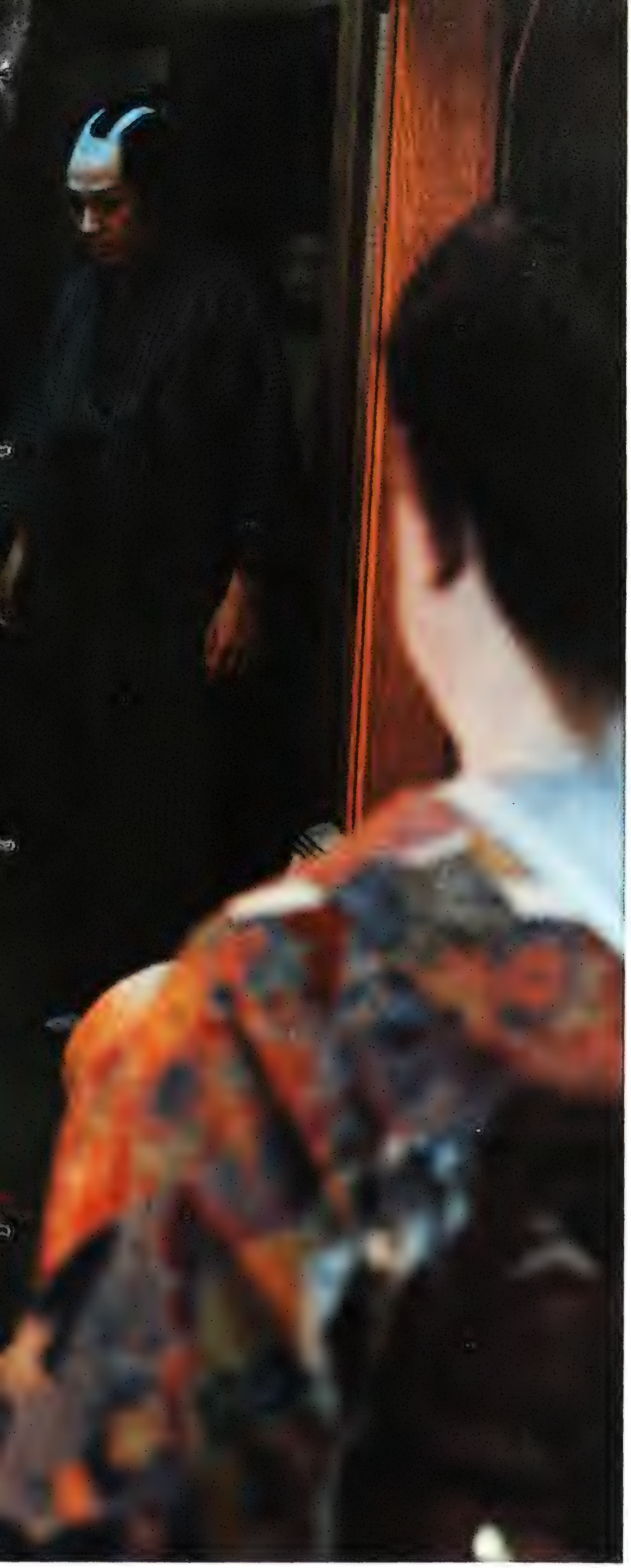
Here are 11 of 70 whom Japan honors for keeping alive ancient arts and crafts that 'progress' threatened to destroy

In Tokyo three decades ago, a group of artists approached General Douglas MacArthur, then supreme commander of the occupation of Japan, to submit a petition. They asked that cultural treasures of the defeated nation be restored and preserved, and that people capable of teaching new generations the venerable arts and crafts somehow be provided for. MacArthur had canceled Japan's major cultural programs on the ground that national funds should not then be spent for such activities.

When the committee of ten artists placed its proposals before him, recalls Gonroku Matsuda (p. 58), sole survivor of the group, "he made corrections on every line; when he finished the paper seemed red all over." They thought they had lost their case, but in May 1950 a law for protection of cultural properties was enacted with MacArthur's approval. Four years later an amendment extended such protection to outstanding individuals working in everything from ceramics to theater arts. They became "Holders of Most Important Intangible Cultural Properties."

Some 70 individuals now hold the simpler designation of "Living National Treasures" and receive annual stipends of 1.5 million yen (currently about $6,250) each; the lives and arts of 11 of them, whose average age is 77, are described here.

Mrs. Fields, a California free-lance writer, went to Japan with her photographer husband, seeking out and interviewing these honored artisans.



This Kabuki actor plays the top female roles

Baiko Onoe, 64 years old, has been a Living National Treasure for 11 years. He is an actor, one of Japan's leading *onnagata* (player of female roles). Most of the year he acts in Kabuki theater; at times he performs in other, non-Kabuki productions. He is being dressed, at left, for the heroine's role in a period play at Tokyo's Imperial Theater.

Both Baiko Onoe's acting tradition and that of Kabuki go back a long way. Baiko, who took the Kabuki stage name of Onoe when he joined the profession, is a seventh-generation actor. Kabuki itself dates from 1586, when a woman named Okuni began giving song-and-dance performances. Included in her troupe's repertoire were sensuous dances and impersonations by women of male characters.

Fearing that public morals were threatened, the government banned females from performing in 1629, and ever since Kabuki plays have been done by all-male casts. Themes of the plays are drawn from Japanese historical and domestic experience. Set to music, they intersperse tear-jerker death scenes and murders with comic moments, and Baiko Onoe is accomplished in all of them.

He performs on stages 90 feet wide where dragons prance, houses collapse, lightning flashes and thunder roars as sets revolve or flip on floors that go up and down. Baiko's is exacting, arduous work, for in Japan a day at the theater often means just that—all day, devoted to one play or several, with time out for snacks during intermission at in-house restaurants.

Maintaining his "feminine" grace means many hours of practice and exercise, along with the training of eight students who often appear on stage with him. The schedule leaves the handsome, husky actor all too little time for his favorite game, which is golf.

"In the Kabuki world," says Baiko, "it is the custom for the son to follow in his father's work." His brother teaches Kabuki at Harvard and his son, at 36, is an actor too. Baiko went on stage at age 6, decided at 18 to specialize in the female roles, and learned such tricks of the trade as tucking a sheet of paper between his knees, the better to walk with the proper pigeon-toed, shuffling gait of an elegant kimonoed lady of the past.

His transformation takes a lot of time. It begins when Baiko applies a white powder paint to his face and arms (the base is made from camellias and helps makeup adhere under hot lights). When it ends, with the aid of attendants who help dress him, Onoe moves gracefully to the stage; he is a convincing woman.

Photographs by Jack Fields

A genius at making *gampi*, king of Japanese papers

Eishiro Abe, 77 and a great-grandfather, pursues a calling that in Japan is 13 centuries old: the production of *washi*, handmade paper. He was designated a National Treasure in 1968 specifically for his *gampi*, a lustrous, vellumlike paper made from a wild thyme shrub. He also makes *mitsumata*, which is strong and water-repellent and is the kind of paper used for printing bank notes.

In the western Honshu village of Yakumo, Abe lives across the way from the thatch-roofed country house where he was born. His home is decorated with *washi* (including the paper on the *shoji* screen behind him, above) and with artworks made from it; the place is known as a "museum" of paper.

He needs and gets much help in his paper making. Neighborhood women gather branches of the shrubs, steam them, rinse them in a stream, and pull them apart into strips. These are scraped to obtain their white inner bark. After more soaking, boiling, rinsing and mixing with *neri*, a tuberous-vegetable starch, Abe with two sons and seven assistants takes over, in a room with a pounded-earth floor, where sit blackened pots and wooden tubs filled with floating white and yellowish bark fibers. The technique is complicated. In a tub is a combination of water and the pulp strands mixed with *neri*, which holds the strands in suspension. Into the mixture he lowers a wooden frame that opens to hold a fine bamboo screen, shaking and tipping the frame to spread the gel-like material evenly. Then he lifts the dripping sheet of paper out onto a nearby stack; it is 90 percent water at this stage. After pressing and drying for a night and a day, the sheet is peeled from the stack and slicked onto a pine or ginkgo board to dry in the sun. When dry it is, unquestionably, handmade paper.

In Tokyo in 1934, Abe's papers were shown in the first-ever one-man show of Japanese *washi*. Since then he has had shows every year. For his 1976 exhibit in New York, which then traveled to Los Angeles and San Francisco, Abe sent 176 different kinds of paper, and his paper shows in Paris and elsewhere have been well received.

Japanese *gampi* was once considered the "king of papers." In his peaceful but busy mountain-valley workshop, Eishiro Abe intends to keep renewing that majestic title and to keep it alive and well.

His goal is to keep the textile dyeing art from dying out

Katsuma Nakamura, 85, keeps his textile-decorating art alive by dyeing $200 neckties, some of which are arrayed before him in the picture above. But it was not for neckties that he was named a Treasure, one of the first people to be so designated, in 1955. He was honored for his past mastery of the *Yuzen* dyeing technique of applying vibrant designs to cloth.

As Japanese textile history goes, it is a "new" technique. It takes its name from Miyazaki Yuzensai, a Kyoto artist of the Genroku era (1688-1704). By using a stick to apply rice paste (the "resist") to silk, outlines of complicated designs could be made. Then colorful dyes were brushed onto the fabric, and the rice-paste resist kept colors from running together. The process revolutionized the making of kimonos, and *Yuzen* dyeing became an admired art form in itself.

As part of the Westernization of the country in the Meiji period (1868-1912), large-scale chemical dyeing methods were introduced from abroad and *Yuzen* dyeing went out of style for everyday garments. But the Japanese still cherish beautiful hand-dyed designs, and artists like Nakamura help to satisfy that interest.

Nakamura lives in an apartment in the city of Chofu, where he displays decorated kimonos on lacquered racks in his studio. Sitting on a floor cushion, he starts his preliminary design work with his favorite tool, a *yatate* or writing-brush he found years ago in an antique shop. When his design is sketched and transferred to a length of cloth, Nakamura takes it to a basement dyeing room. Here he carefully traces over the design with a stick dipped in a paste of rice. This "resists" the dyes that he later hand-applies with brushes. For elaborate designs the process is repeated many times; after each dyeing the resist is washed or brushed off. Finally the material is steamed to set the dyes; the embroidery, if any, is done; and the fabric is ready to be made into a finished garment.

It is painstaking, highly creative work. And while, as Nakamura says, "*Yuzen* can be done on any kind of fabric," it is costly work too. The most expensive garment he ever made was a wedding kimono for ten million yen (about $42,000). The family for whom he made it considers it a potential heirloom whose value increases yearly; in time they may donate it to a museum. Meanwhile its creator, still dyeing, is busy writing poetry and a book about his craft.

Master hands fashion simple pottery of great price

Kei Fujiwara, 80, is a potter whose signature is a stylized design of a wild goose in flight. His medium is Bizen stoneware, created out of a clay dug from under rice fields. His village of Bizen is in Okayama Prefecture, one of the oldest ceramic areas in Japan. His stoneware is in rich earth tones and its textured surface rings like metal when struck.

He is up as early as 4 A.M., and throwing pots by 7 o'clock. An assistant hands him a lump of gray clay, kneaded to limberness, and Fujiwara slaps it onto an electrically powered wheel. Pushing up his kimono sleeves, he centers the clay with his hands. Soon he stands, pulling the clay up with both hands, one working on the inside of the rising cylinder, the other on the outside. Once he has guided the clay into its final shape, he stops the wheel.

He considers this pottery making easy; what turns clay into art is the yearly loading and firing of pots in the kiln. He may take a week loading it so that each piece benefits most from the 1,300-degree C firing that lasts 12 days. The red pine ash rising on the fire updrafts will settle down in artistic patterns on his vases and teacups. Left to cool for a week, the kiln is opened like a big surprise package, and what comes out is treasure of great price: a bowl for green tea may bring two million yen because Fujiwara's production is low. He says, "When I was younger I tried to be a technician and make complicated designs, but now I prefer simple ones. Simple things are the most difficult."

His body and spirit merge with his puppet's

Tamao Yoshida, 60, had never even seen a puppet play when he decided at age 14 to make a lifework out of manipulating puppets *(ningyo)*. He chose his career because puppeteers have no spoken lines in Bunraku Troupe performances—and he does not like to speak.

He works as the chief manipulator on foot-high clogs behind a 44-pound doll, and while the audience sees his face his two black-clad, hooded assistants (right in photograph) are supposed to be invisible.

Tamao owns only the skeleton of his puppet. Its construction is comparatively simple. A long handgrip slides down through a hole in the wooden shoulderboard, to which the arms and legs are tied. Strips of vegetable sponge pad the shoulderboard.

Costumes belong to the Bunraku Association, as do most of the interchangeable heads. There are about

50 types of heads all told, ranging from mature, strong-willed men, reminiscent of *samurai* ideals, to "walk-on" parts. As for hairdos, heads have their own hairdresser—a profession in itself.

It takes strength to hold a heavy puppet at arm's length while moving its body parts synchronized with the voice of a narrator who sings, chants and recites the dialogue, paced by a samisen player.

To keep in training, Tamao does a lot of bowling, which he finds good for toning leg and loin muscles. To keep his arms in shape, he chins himself. "I must stand very erect," he says. "Even young men cannot hold a 20-kilogram puppet so easily." During a performance, he says, "I become the character portrayed—my spirit enters the puppet to become as one."

Tamao was designated a Living National Treasure in 1977 to replace a deceased puppeteer. He plans to continue his career indefinitely—after all, the oldest puppeteer in his troupe died at 93, and Tamao Yoshida is a relative youngster at only two-thirds that age.

He strikes his massive bell at noontime every day

Masahiko Katori, 80, is Japan's most famous bell maker. He has specialized in casting bells for Buddhist temples, like the huge and cumbersome *kane* he is striking above with a heavy, rope-handled red pine log. He rings it every noonday, knowing that in a number of temples, bells he has made are also tolling with great, reverberating "boinngs" at the noon hour. The signal is a tradition almost 400 years old and grew up with the popularity of knowing the time of day.

While size is impressive in a Japanese temple bell, it is the sound by which its quality is judged, and Katori claims he has never made a bell—he has now cast 89 of them—whose sound did not please him. His secret of deep, resonant sound is the correct temperature of the molten metal, 85 percent copper and 15 percent tin, as it is poured into the mold.

The largest one he ever made weighed 11 tons and was about seven feet in diameter. Smaller in size but large in sentiment was his Bell of Friendship, presented in 1958 to San Diego from its sister city, Yokohama.

It takes Katori about a month to cast a bell, much longer to create the design to be carved into the mold for the bell. He sketches at home, in a Tokyo suburb, and drew a design of plum blossoms for his most recent bell. He is a versatile artisan. When a northern temple gave him an assignment, he created a design of potatoes because the area was a potato-growing region. The people were delighted to have the humble vegetable honored on their temple's bell.

This woodcarver, at 75, is master of many trades

Tatsuaki Kuroda, 75, is a lifelong lover of wood and it was as a woodworker that he was named a National Treasure in 1970. Working in wood is only one of his many talents; he is known as Japan's great *raden* master, who created a decorative mother-of-pearl-in-lacquer tray for the new Imperial Palace in 1969.

Surrounded by the many tools of his trades (he uses, for example, more than 150 planes of different design for his woodworking), he lives in a rambling wooden house in the hills outside Kyoto. It has been his lifestyle to master new techniques. Half a century ago, at 24, he was already expert in the whole complex spectrum of the lacquerware process, known nationwide for his intricate abalone-shell designs laid in lacquer. And more: he became famous as a cabinetmaker, furniture designer and a "midwife of wood," as he has also been called.

Kuroda's wooden paper knives, which leave a favored "raveled" look on the paper they cut, cost hundreds of dollars for good reason. He takes at least five days to carve a knife out of a raw log. Then 20 coats of clear lacquer are applied, with drying time of a day between each coat. With accompanying rubbing and polishing, it adds up to about a month's labor for each knife. And at a cost of about $170 a pound, the pure lacquer Kuroda uses is one of the world's most expensive finishes.

Five years ago the woodcarver's love of fine wood came to the rescue of the house he now lives in. The farmer who owned it was about to destroy the old-fashioned homestead to make room for a new, prefabricated house. Kuroda heard of it, bought the house, had it taken apart to be moved 150 miles and had it reassembled. Huge hand-cut beams span the ceilings, and foot-smoothed wood welcomes the bared foot.

An enclosed veranda, the width of the house front, is Kuroda's woodworking area where he and a son, both more than six feet tall, fold themselves onto floor cushions at a low work table. Holding a plane between long fingers, the father pulls it lightly toward his body. A tiny ringlet of wood joins a growing pile of curls on the floor, like discards around a barber's chair. The source of the ringlet, a roughed-out paper knife, is slowly taking shape.

An upstairs workshop is devoted to lacquerware. Apprentices bend over more low tables, making bases for Kuroda's *raden* boxes. Drying rooms hold the temperature at 30 degrees C, with humidity kept at 85 percent. Speed is disregarded in this house. Between receipt of an order and delivery of a piece of furniture, years may pass—and so may the purchaser.

Last master of a hard stencil-cutting method

Hiroshi Kodama, 70 (below), is a stencil cutter and probably the world's last master craftsman practicing the *shima-bori* or stripe-cutting technique, a most difficult art. An example of its intricacy is shown opposite, below; the dark area is the stencil, the light areas are those that have been cut away. In Japanese the term *katagami,* for stencil cutting, comes from *kata,* for pattern or stencil, and *gami,* for paper. Ise-*katagami* locates the center of the craft, the Ise Shrine dedicated to the sun goddess Amaterasu, near Kodama's village of Shirako. Here his predecessors were cutting stencils three centuries ago.

Considering the arduous delicacy of the work involved, the decline is hardly surprising. The end product of Kodama's work is a stencil-dyed pattern on fabric, usually silk to be made into a kimono, but even the preliminary steps seem appallingly complicated. First, he designs his patterns. To cut the stencils, he begins with stencil paper about 9 by 16 inches, the width dictated by the standard size of Japanese bolts of cloth. The paper, made from mulberry tree fibers, must be free of flaws that might deflect his cutting knife. Two sheets, one horizontally grained and the other vertically, are pasted together using persimmon tannin. After being dried in the sun, the paired sheets are stored for several years, while the persimmon tannin

colors the paper layers warm brown.

With a flat bamboo spatula, Kodama separates the sheets. Fourteen or 16 of them are stacked and fastened to be cut as one. Using a small knife, he makes a slow pull, holding a steel ruler with his left hand as a guide. He starts and stops at marks made on the top sheet, then repeats the motion twice more, the knife cutting deeper in the same slit as it goes through the paper layers. Barely moving the ruler, he makes another cut a scant millimeter from the first. When these long cuts are finished, every other strip will be severed at top and bottom and removed.

Between the cutting and the dyeing comes painstaking work for Mrs. Kodama. She inserts fine silk thread between the double sheets of the stencil to add strength; the gossamer grid she has strung on the pegs of a wooden frame is wetted with persimmon tannin and precisely sandwiched between the two sheets. The stencils are dried and put in storage. It can be four years before Kodama sees fabric dyed with his design.

When Kodama's stencil is finally used, a resist will be applied to fabric through the stencil's slits. Then when the fabric is dyed it will be finely striped. His stencils are durable enough to last through 150 dyeings.

Kodama says that during the time of his father there were some 2,000 stencil cutters in the area. But only his father and one other cutter had the patience and care for the stripe-cutting technique. Now it is only Hiroshi Kodama.

He keeps the faith– and art–of lacquerware

Kodo Otomaru, 81, began the serious study of lacquer art as a boy of 13, and has spent his long lifetime in a medium that in Japan goes back more than 2,000 years. Lacquer is derived from the sap of the *urushi* or lacquer tree. One account relates that in the second century A.D., a prince broke off the branch of a tree and noticed that the stinging sap turned shiny black on his hand. When he commanded one of his vassals to begin using the substance to cover various objects, the tradition of lacquering was recorded in Japan. Excavations have yielded lacquered objects of even earlier date, however.

By the eighth century there was a Guild of Lacquerworkers in the country, and a land-ownership system gave each household a garden plot, provided the family grew mulberry trees to supply paper makers and *urushi* trees for lacquer artisans.

In a few centuries the fame of Japan's lacquer art spread worldwide. China sent students to study the increasingly refined skills, and Europeans took to calling anything with a lacquer finish "japanned."

Using an "iris box" as a model, Otomaru demonstrated two of his techniques out of the many that have been developed. He starts with a plaster-of-paris mold shaped like a cube, over which he shapes layers of hemp cloth soaked in lacquer. Once the lacquer hardens, the mold is removed; the body has been formed. This technique is called *kanshitsu* (dry lacquer).

For the decoration of this particular object the *choshitsu* (carved lacquer) technique is used later. To prepare the surface for carving, Otomaru must apply some 100 coats of lacquer, carefully planning the colors of the layers. This takes a year or more, since each successive layer must dry thoroughly between applications. When the layers have reached a thickness of a tenth of an inch, he sketches a design on the surface. When he carves out the design, the colored layers underneath are revealed. Final rubbing gives the box a glassy sheen.

While the "iris box" series he uses in the demonstration takes 100 coats, some objects require as many as 1,000 coats of lacquer.

Otomaru has always attempted the most difficult tasks, a characteristic peculiar to him since boyhood. "The impossible is a challenge," he likes to say. And if he creates an item he considers less than perfect, he simply breaks the mold. "I did not learn this from a master," he says. "It is my own philosophy."

Like other Living Treasures, Otomaru has several apprentices or disciples, as they are also known. They, in time, will follow his philosophy as well as pursuing his artistry.

Her marijuana is not for anything but dyeing

Ayano Chiba, 89, is considered to be the sole citizen of Japan with practicing knowledge of the ancient method of producing indigo-dyed hemp cloth, from plants to finished fabric. She illustrates one crucial step (opposite) in the long process. With strands of marijuana fiber stuffed in her mouth, she pulls out one strand at a time, wetting its end to the next one and coiling the hemp thread in a pile below her.

Cotton does not grow well in northern Honshu, and for 2,000 years the Japanese have used fibers from hemp, *Cannabis sativa,* or marijuana, for weaving durable cloth. While the "high" effect of smoking or eating marijuana has been known that long, too, the Japanese have associated *asa,* as the fibers are known, with different values. Once bundles of *asa* were important as marriage gifts, and because the plant takes dye colors well, it gave rise to the saying, "wives must be willing, like the *asa,* to be dyed any color their husbands choose."

The only color Chiba uses for dyeing her hemp thread is natural indigo. She grows it on her farm in the Kurikoma Valley. This true indigo, indigenous to India and believed to have been brought to Japan via China, has been used as a dye for 4,000 years.

Chiba grows two crops of indigo a year. She spreads the leaves to sun-dry, stores them until winter, ferments them for three months, pounds them with mortar and pestle, then shapes them into balls for summer dyeing.

On her farm Chiba motioned to me with a downward wave of her hand, a typical Japanese "come here" signal. She stood at the edge of a crowded field of light-green marijuana plants about three feet high. She measured herself against the plants—she is bent with age to less than five feet tall—then stretched one arm straight up to indicate the six-foot height the plants would attain before harvest time.

"Every year I must apply for a new growing license," she said. "Of course, I always get it—I'm the only one applying." The license is free, but the government allows only one to each prefecture. She keeps a close watch over her untended field, and even declines to give away marijuana-plant refuse.

In May 1955, just as the indigo planting needed attention, a letter arrived notifying her that she had been designated holder of an "Important Intangible Property." Realizing happily that her future would be forever changed, Chiba kept on doing what she most wanted—cultivating her farm and passing to various relatives her intimate knowledge of how to make indigo-dyed hemp cloth.

The dean of the Living Treasures (p. 50) is Gonroku Matsuda, 83, a noted lacquer artist.

RECALL THOSE GOLDEN MOMENTS

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The Gold dust used in this unique piece of Collector Jewelry is taken from the creek beds and streams located in one of America's oldest and most famous gold mining districts — "Gold Hill" — near Boulder, Colorado. It is slowly and painstakingly "panned" by hand in the very same way that Rocky Mountain prospectors have been collecting gold dust and nuggets ever since the Gold Rush Days in 1849 — for over 130 years.

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To assure the rarity, the Limited Edition version of these extraordinary Pendants is being restricted to just 2,500 pieces, worldwide. They are being issued exclusively through our organization, the Limited Editions Collectors Society of America, and are being offered to collectors of fine, handmade jewelry, and to those individuals who are seeking truly unique "Collector Jewelry" pieces for gift-giving.

The design (which is protected by a copyright) was created at the J. T. Inman Goldsmith workshops. Perhaps you have already heard about, or seen, some of the other original creations which have been handmade at Inmans. They are a small "specialty" jewelry model shop, located in Attleboro, Massachusetts, that has been designing and making unique, fine, handcrafted "specialty" jewelry since 1882, serving clients such as Tiffanys, Cartier, Neiman Marcus, Shreves, Halls, and other fine jewelers for many years.

These extraordinary Pendants were created by Inman's designers exclusively for us, for sale to members of the Collectors Society and to other collectors interested in participating in this Limited Edition offer. They will <u>not</u> be sold through retail jewelry stores or department stores, and the *only* way to obtain them is by responding to the Society's advertisement.

A Registered Edition is also available in 14 Karat Solid Gold or Gold Vermeil (Solid Sterling Silver plated with Gold). However, when the Limited Edition is completed and sold out, all dies and molds will be destroyed, and both Editions will be closed forever.

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Crystal contains pure placer Gold Dust
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The Collectors Society is a private organization, founded by a group of avid collectors, art lovers, and historians, including some who have distinguished themselves in the fields of Arts and Letters. In addition to creating and marketing unique and exclusive fine Collector Jewelry, the Society also issues authentic reproductions and replicas of historic artifacts, plus exclusive artworks and official Commemorative products. It has received a number of important awards for excellence and has been commissioned by a number of non-profit organizations, including the Winston Churchill Foundation, the Freedoms Foundation at Valley Forge, the Old North Church Museum, and the John F. Kennedy Library Fund, to create and market their official commemoratives to collectors.

Every collector item issued by the Society is protected with a Certificate of Authenticity signed by the Chairman of the Board of Trustees of the Collectors Society. Your Certificate, showing the serial number of the particular Pendant sent to you (the number recorded in the Society's Master Registry of Ownership and microfilm library), will be sent to you within thirty days after you have received delivery. This protects your investment against inferior imitations or counterfeits and also documents the value of your serially-numbered Pendant for insurance purposes.

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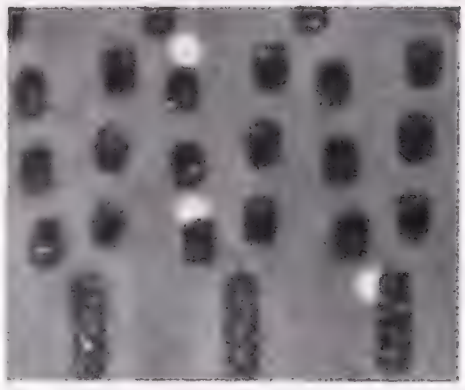
When is a bubble not a bubble?

Answer: When it's a magnetic bubble—a tiny magnetic area less than 1/10,000th of an inch in diameter contained in a thin layer of crystal. About five million bubbles have been stored on a crystal chip about the size of a dime.

The presence or absence of bubbles (the white dots in the photo at right) represents bits of information—ones and zeroes. They can be moved about at high speeds to perform memory and logic functions. Two perforated metal sheets (the holes appear as dark rectangles in the photo) create the alternating magnetic field that moves the bubbles around.



In this photo, magnetic bubbles (white dots) are magnified 1,000 times.

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Bubble memories have a simple structure and are relatively inexpensive to make. They are rugged and reliable. They use little energy and do not lose the information stored in them even if power is lost.

That's why the Bell System uses bubble memories, manufactured by Western Electric, for storing recorded voice messages such as: "The number you have dialed..." We're also using them for testing microwave transmission systems that carry voice, data, and television signals. Someday, a bubble chip the size of a postage stamp may store the contents of an entire telephone directory.

Magnetic bubble memories were invented at Bell Labs in 1966. Since then, we've been improving the technology constantly. With our latest advance—using the perforated metal sheets, instead of a pair of external coils, to move the bubbles—we've been able to cut the size of bubble devices by about a third, move the bubbles ten times faster, and cram four times as many of them on a chip.

Bubble devices are being put to use in telecommunications, data processing, and consumer electronics industries. Bubbles are particularly attractive in combination with microprocessors, providing program storage for a computer on a chip of silicon.

Inventions such as magnetic bubbles don't occur every day at Bell Labs. But innovation is an everyday occurrence. Our bubble patents are among nearly 19,000 we've received since our incorporation in 1925. That's an average of nearly two per working day.

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By Robert Wernick

One-eyed jacks, like the rest of us, aren't that wild

Despite all the sinister legends, there is no cause to look askance at the world's monocular minority, most of whom go quite unnoticed

"My father-in-law came down for breakfast," said the pleasant lady beside me in the doctor's waiting room. "He sat down at the table across from me like he always does, and I began to scream and scream. I never screamed so in all my life." She paused to spur our interest. "Here I'd been living under the same roof with that man for 15 years, and I never knew that he had a glass eye. And what did the old fool do that morning, he put it in upside down!"

I was only having my eyes examined there but, after a couple of botched operations for a retinal detachment, I joined that father-in-law in the great uncounted minority of the one-eyed.

I know our numbers are great because every time I mention my own state I learn that somebody else whom I always regarded as perfectly normal is one-eyed too. This one had an eye kicked out in a football game, that one when a cable snapped on an oil rig. My own family physician was born with a congenital cataract. At a recent dinner party I met one lady who lost an eye pulling weeds, and another whose retina was jolted loose while bicycling on a bumpy road. An

Scandinavian god Odin gave an eye to drink from spring to satisfy thirst to know all and see all.

In Homeric legend, Odysseus blinds the Cyclops Polyphemus

eye doctor in New York tells me he suspects there are hundreds of thousands of us.

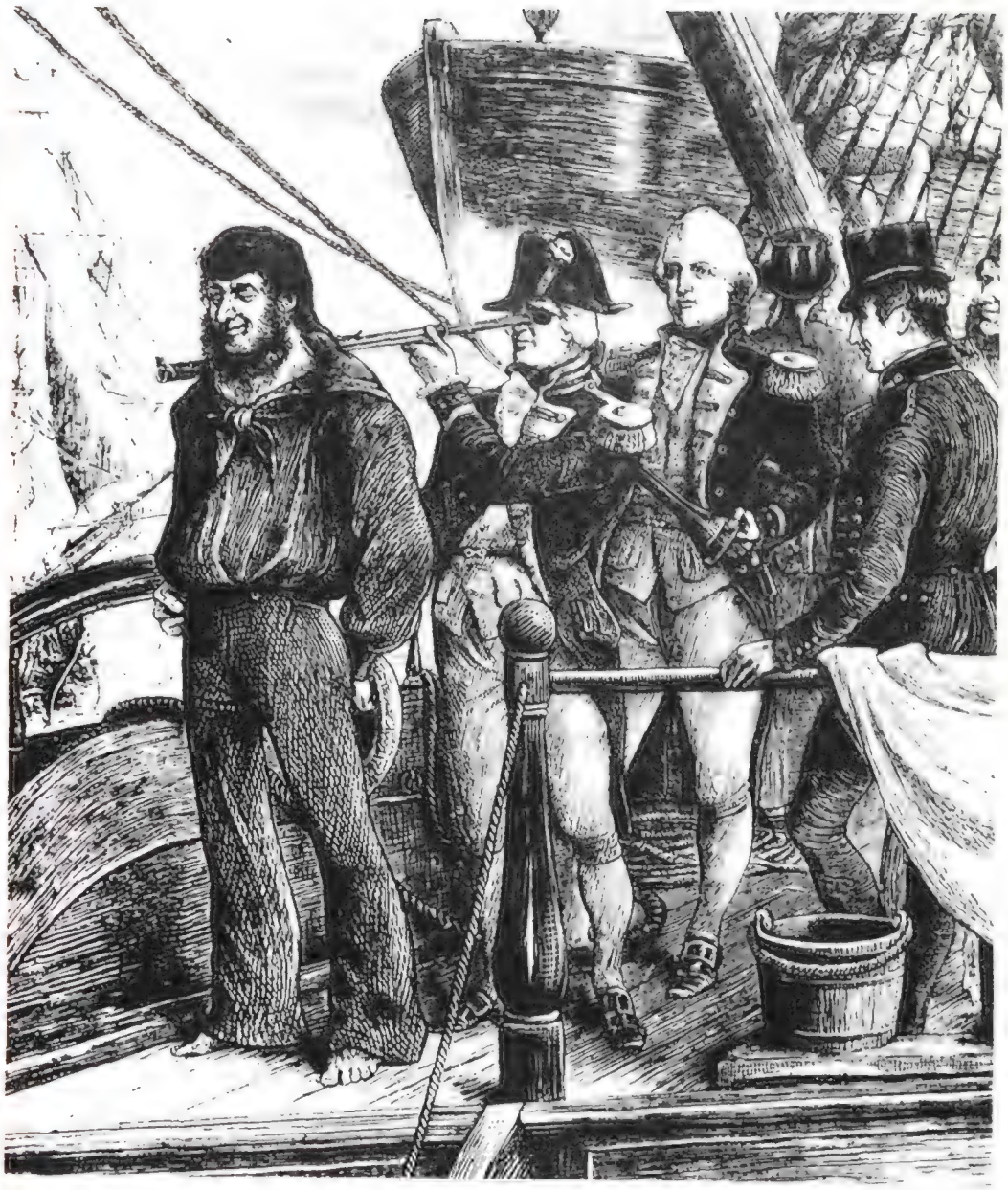
But how many, no one has the slightest idea. No computers, no punch cards, are programmed for this interesting statistic. Unlike others in this minority-conscious age, we have little desire to stake out a separate position for ourselves; most of us are content to "pass," to merge into the great binocular majority. It is really quite easy to do so, as I discovered when the bandages came off. The field of vision was reduced much less drastically than I had supposed—I can mingle in crowds, drive a car or hit a golf ball—although children, bicycles, dogs, did develop a way of turning up with disconcerting suddenness on my right, or blind, side.

Some ill-tempered people never get used to this phenomenon. There was a Boston society lady who was known, when friends or waiters approached her from the wrong side while she was having tea at her club, to snap around and bite them. But I have found that with ordinary prudence I can maneuver even through the maelstroms of traffic in places like Paris without unpleasant surprises.

I had learned at school that having two eyes gives us stereoscopic vision, combining two slightly different images in ways that provide accurate perception of depth, enabling us to place things exactly where they are in the outer world. This is a great evolutionary achievement of the primate order, the early apes, monkeys and their kin, whose eyes many millions of years ago began to move around to the front of their heads. Some would say that stereoscopic vision along with upright stature and the prehensile thumb helped give humans a mastery over nature denied to the beasts. Other animals, like the big cats, may have a keener eye for minute motions in the distance, but none of them can pick out the wonderfully clear and subtle details which make up the world we look on every day. Most of them are color-blind, and occasionally it al-

Robert Wernick, a frequent contributor, wrote on the Norton Simon Museum in September 1979 issue.

with red-hot stake. Detail above is from painting by Pellegrino Tibaldi.



Horatio Nelson chose not to see signal to withdraw in 1801 battle against Danish fleet, which he won.

most seems as if sight is more of a handicap than a help: what in thunderation could Moby Dick have made of what he saw out of his two little eyes, staring at two diametrically opposite and totally dissimilar seascapes, perhaps a school of herring on one side and Captain Ahab brandishing a harpoon on the other?

I hardly expected to go back to an earlier evolutionary stage when I was reduced to one eye. But I expected the world to be flat; I expected the perception of depth to be gone or at least distorted. Not a bit of it. A lifetime of experience is just as good as stereoscopic vision at telling me where objects are in space.

Perhaps I give my head a little imperceptible and unconscious wiggle to provide parallax. At all events, there is no serious problem. Perhaps there is some imperfection of detail: I would not recommend a one-eyed brain surgeon. But on the average job a single eye is no handicap. In some situations it may even be an advantage. You don't have to make the effort to squint the other eye when aiming a rifle. You may have noticed that drinkers have a tendency to let one eye droop after a certain number of glasses. This is an unconscious reaction of the body which, no longer being able to coordinate vision, removes one eye temporarily from the action; just as the same drinker will consciously close one when he is driving home and sees two red lights in front of him. The one-eyed drinker avoids these problems.

We have merged into the mass of our binocular brothers, so that in general we are not as wild as are one-eyed jacks, spades and hearts (p. 63), in some card games. There is, in English, no name for us. I suggest we pick one out of Greek mythology: Arimasps. The Arimasps are known to us from a few lines in Herodotus, who related a tale told by a poet named Aristeas, a remarkable bard who reappeared after his death to read his own verses. Aristeas says the Arimasps were a tribe of barbarians living in the Scythian steppes north of the Black Sea. They were one-eyed horsemen who spent their lives in desperate and dangerous efforts to loot caches of gold which were guarded night and day by griffins, winged lions with eagle beaks.

World's monocular minority

One-eyed images adorn (left to right) Great Seal of United States (as symbol of all-seeing deity); ornament

Thievery seems a fitting pursuit for the original Arimasps. Whenever one-eyed characters appear, in history as in mythology and in popular superstition, there is likely to be something abnormal, ambiguous, unsettling, often threatening, something disreputable about them. In some European languages, in fact, the adjective *one-eyed* has a secondary meaning of disreputable—*un hôtel borgne* (one-eyed hotel) in France is the kind where you sleep in your clothes and put the legs of your bed in your shoes.

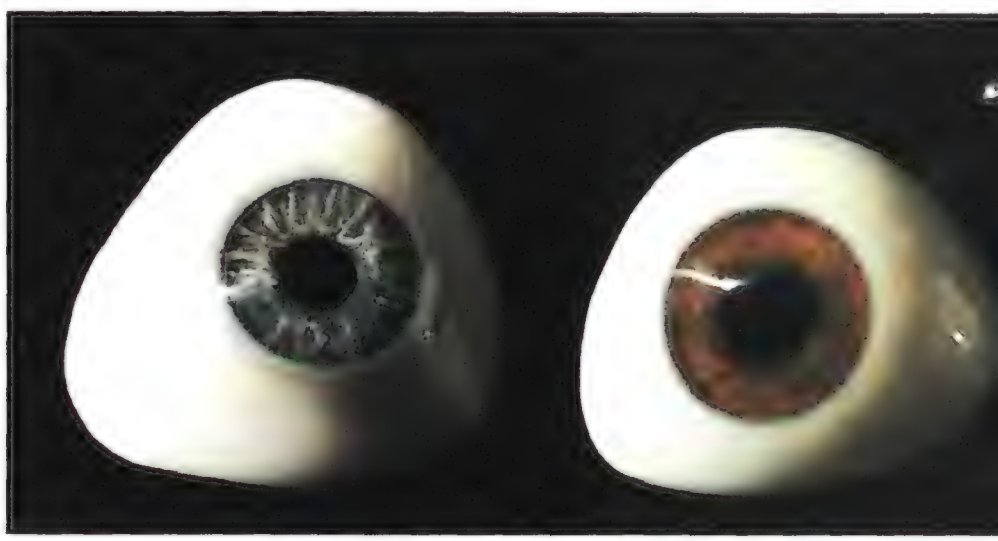
If it is the right eye that is lost (like mine), the left may well turn, in many parts of the world, into an Evil Eye, capable of blasting crops, infecting cattle, causing automobile accidents. If the left eye of a corpse will not close, it is well known that someone else in the family will die soon.

Even if not regarded as wholly criminal or wholly evil, the Arimasp may still bear a lingering reputation for being more devious, sly, clever than his or her neighbor. An old folktale has a one-eyed man say to his two-eyed neighbor: "I bet you a hundred crowns I can see more than you can." "Done," says the other, sure of some easy income. "Look at me and pay me," says the first. "You see only one eye and I see two."

A similar sharpness was displayed in the bright light of history by the extraordinary sea lord Horatio Nelson, who lost an eye fighting the French at Calvi on Corsica in 1794. Seven years later he was commanding a fleet of small ships outside the harbor of Copenhagen. His superior, Sir Hyde Parker, reluctant to take his heavy ships of the line through the treacherous channels, sent in Nelson with the smaller ships. Seeing one frigate run aground on a shoal, seeing all the smoke of the Danish batteries, Parker hoisted the signal for a withdrawal. Nelson clapped his spy glass to his blind eye, saw no signal, and went on to silence the Danish fleet and cow the Danes into surrender.

Often the loss of an eye has been seen as a judgment of God on the unrighteous: "Woe to the idol shepherd that leaveth the flock!" says the prophet Zechariah, "the sword shall be upon his arm, and upon his right eye: his arm shall be clean dried up, and his right eye shall be utterly darkened."

King Philip II of Macedon lost an eye in battle in retribution for having impiously peeked through a chink in the door to see his wife Olympias performing Orphic rites. "Zealously affecting these fanatical and enthusiastic inspirations," says Plutarch, she "was wont in the dances proper to these ceremonies to have great tame serpents about her, which sometimes creeping out of the ivy in the mystic fans, sometimes winding themselves about the sacred spears, and the women's chaplets, made a spectacle which men could not look upon without terror." It was believed that on the occasion of Philip's misguided curiosity, the queen was copulating with one of these snakes—really a god in



Modern plastic eyes, ready-made or custom-fitted, have replaced glass eyes which were first made in 1579.

from King Tut's tomb (a symbol of the sun); and medallion said to portray Philip II of Macedon.

disguise—and out of this union came the child Alexander, who conquered much of the world.

Some peoples have held that God himself is one-eyed, perhaps because they felt that an imperfect world like ours could only have been made by an imperfect Creator. In one version of ancient Egyptian cosmogony, Ra, sun god of Heliopolis who created first himself and then (by masturbating, spitting) other gods and earth and sky, had a divine eye which was separable and capable of wandering off by itself. According to one account, this eye went off to look for two of his children who had strayed away, and was replaced; when the first eye returned it was enraged at being usurped. Ra placed it on his forehead, and appointed it to rule the world which he was about to create. The *uraeus,* the serpent on King Tut's brow, symbolizes this eye. Another account has it that Ra sent his two children Shu and Tefnut to bring back the wandering eye. It fought with them, and wept when it was captured, and from these tears sprang the race of men.

Even earlier artificial eyes made of painted clay were used by the Egyptians in the fifth century B.C.

In cold, distant Scandinavia, the god Odin claimed to be god of wisdom, poetry, war, agriculture and the dead, many of these titles achieved by adventure and trial. Odin had a thirst to know all, according to Snorri Sturluson, a 12th-century Icelandic poet and historian. Odin knew that under one root of the ash tree Yggdrasil lived the spring of Mimir, in which was hidden wisdom and understanding. He went there and asked for a drink from the spring, but he did not get it until he had given one of his eyes as a pledge.

Odin is more familiar as the great master of Valhalla, the vast, glittering palace where a race of dead Norse warriors spent their days in battle games and their nights in feasting and drinking. But he was not a mere mindless battle god. He was a magician, a schemer, a poet, sly and unpredictable, a real Arimasp. Snorri, in his saga of the kings of Norway, tells how in later Christian times King Olaf Tryggvason was joined during Easter by an old, one-eyed man in a broad-brimmed hat who kept him spellbound most of a night with tales of distant lands and marvelous events. It was only at daybreak when the storyteller had mysteriously disappeared that the king realized it had been the god Odin himself, come to let people know that though he was temporarily out of a job, he had not given up and would be around for a long time yet.

A man-eating Cyclops undone by wine

In ancient Greece there were giants called Cyclopes with a single horrid eye in the middle of their foreheads. The most famous was the Polyphemus who appears in Homer's *Odyssey*. According to Homer, the Cyclopes were uncouth shepherds, cannibals who ordinarily drank only pure goat's milk. Polyphemus had eaten a half dozen of Odysseus' shipmates when the crafty Greek gave him a skinful of undiluted wine, the taste of which pleased him so much that he promised to eat Odysseus last. When he fell down drunk, the survivors took a stake of olive wood, whittled to a sharp point, reddened it in the fire and drove it into the Cyclops' single eye (pp. 64-65). Even blind, he was a fearful menace. Taunted by Odysseus and his men, who had escaped from his cave and were far out to sea, he hurled out the peak of a high mountain, almost shipwrecking them all. Fortunately he was stupid as well as fierce. Odysseus had told him his name was *Outis,* meaning Nobody. When his fellow giants came running up to help him after they heard his screams, they asked what happened. "Nobody has blinded me," he howled, upon which they quite naturally went on their way.

We need not be ashamed of counting Polyphemus

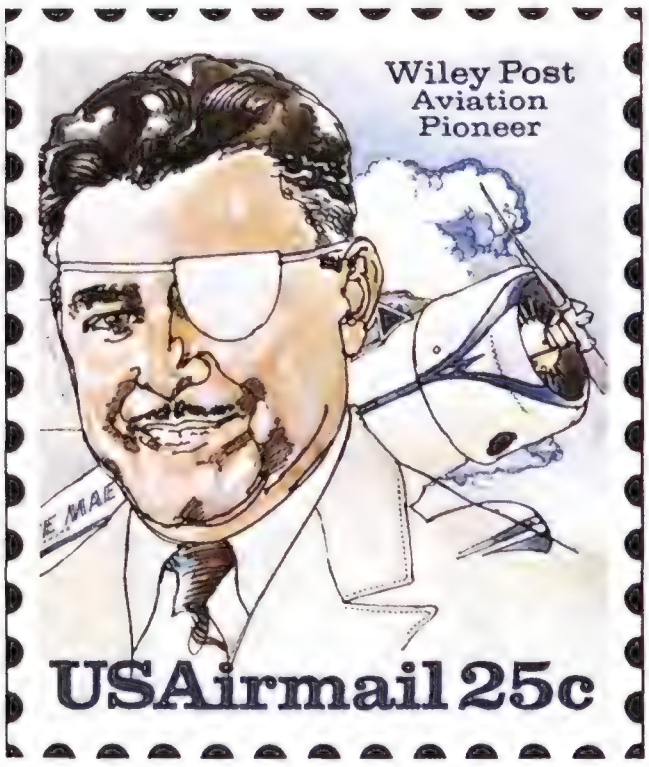
among the Arimasps. He is a savage and altogether repellent figure in Homer. But the Alexandrian poet Theocritus portrays him more gently in his youth, a blundering awkward downy-cheeked giant, tongue-tied for love of the sea nymph Galatea, unable to understand why she will not come to his bed though he can offer her 11 fawns and four little bears.

There are other fearsome one-eyed giants flickering through the folklore of many lands. The Tartar hero Bissat and the Celtic hero or god Lugh both used red-hot weapons to burn out the single orb of wicked giants during their ancient wanderings. So did Sinbad the Sailor on his third voyage.

Apparently, the prehistoric figures took no steps to hide or replace their missing eyes. Presumably in those rude old days they left the socket empty. Modern man finds this unsightly and has adopted different techniques for concealing the loss.

Often, perhaps in a majority of cases, there is nothing to conceal. Except to the very observant, a dead eye can look much the same as a live one, and few people are that observant.

However, when there is marked physical deterioration, it is usual to put in an artificial eye. Glass eyes date no further back than the late Renaissance, when Venetian glassmakers ingeniously created the art. It developed prodigiously over the centuries, especially in Germany. The craftsmen there could make products so natural-looking that a popular tale sprang up which has been repeated in many forms throughout the world. The most modern version I came across was an episode during World War II when an SS officer in Poland found himself called upon in the line of duty to shoot down a ten-year-old boy. This officer had a glass eye of which he was very proud; it was a real masterpiece, positively sparkling with life. Feeling genial that day, he decided he would give the little fellow a sporting chance for his life, and promised him he would let him go free if he could identify which of his eyes was man-made. The boy looked up, didn't hesitate a second, pointed to the right eye. "How the devil did you know it?" cried the SS man. "I have fooled people for years with this eye; how could you possibly have known right away?" "It was simple,"



World-hopping aviator Wiley Post, who died in a crash with Will Rogers, was used on 1979 airmail stamp.

Correspondent Floyd Gibbons lost eye during 1918 battle in France and became a dynamic radio voice.

Israeli general Moshe Dayan owes eye patch to World War II injury while with British forces in Syria.

said the youth, "I picked the one that looked human."

Glass eyes are rarely made in this country; artificial eyes these days are more apt to be of plastic. Traditionally, artificial eyes were made by old family businesses which handed down trade secrets over the generations, but today there are hundreds of ocularists, or eye-makers, in the United States. They are quite secretive about their clientele, for most people who wear artificial eyes see no reason to make the fact known. Only occasionally does the public learn that some well-known figures like Congressman Morris Udall or actor Peter Falk have such eyes. Sammy Davis jr. does too, replacing one he lost in an automobile accident.

The main reason for an artificial eye is to be invisible, so to speak. But there are those who scorn the pretense of an artificial eye altogether and would just as soon call the world's attention to their deformity by sporting a sinister black patch, of the kind worn by General Ritchie-Hook in Evelyn Waugh's war trilogy. Arimasps everywhere have a warm feeling for this old scalawag as he goes to a hero's death in Yugoslavia, his one eye fixed on the enemy lines he is storming, quite unaware that he has been abandoned by all his men and is being followed only by a photographer.

Horatio Nelson wore a patch. So did Ana de Mendoza, a lovely lady of 16th-century Spain, of a family so old and proud that she could regard King Philip II as a Flemish parvenu. She is said to have lost an eye at the age of 14 while dueling, and the silk patch she wore over it was considered a perfect complement to the striking but irregular beauty of her features (p. 71). She plunged into a succession of political and amorous intrigues which added a lurid sparkle to the gloomy court—and inspired a novel and a play, which imaginatively describe her final days locked in an apartment of her palace by the king with the windows walled up so that her one lovely eye should never see the light of heaven again.

Piracy was another trade in which an eye could be lost, and the black patches associated with buccaneers on the Spanish Main became a kind of badge of the profession. Fictional pirates like Captain Hook in *Peter Pan* kept up the tradition.

In recent times, eye patches have been worn, with considerable dramatic impact, by Floyd Gibbons the war correspondent, by Wiley Post the aviator, by Raoul Walsh the movie director and by Moshe Dayan the Israeli general, who lost his eye while scouting with the British against the Vichy French in Syria in 1941. He suffered the injury when a telescope he was peering through was struck by a bullet.

All these are rakish, romantic figures, and they float around in that part of our unconscious mind where images of excitement and glamour are stored. They must have been floating around in the mind of a young advertising man named David Ogilvy one day in 1951. He had been given a modest budget of $30,000 to whip up some publicity for an old but small shirt manufacturer, and it seemed pitiful against the $3 million which Arrow spent every year on its advertising campaigns. Ogilvy tried out more than a dozen ideas before the flash of inspiration came. The result was

Comedian Sammy Davis jr wears plastic eye in place of one (his left) lost in an automobile accident.

Pioneer Hollywood director-actor Raoul Walsh lost an eye in 1928, the year that movies added sound.

Hathaway shirt man, Baron Wrangel, only acted the part, donning patch to create an eye-catching ad campaign.

Baron George Wrangel, a White Russian refugee, who had been working as greeter in a midtown New York hotel and now appeared, dashing, disillusioned, world-wise, in Hathaway shirt and black eye patch, facing 50 million potential customers all over the United States. It made the fortunes of both the Hathaway people and David Ogilvy.

Victor Hugo, who had something profound or something profoundly silly to say about everything (he was once accurately described as a madman who thought he was Victor Hugo), took on this subject too. The one-eyed man, he said, is more incomplete than the blind man, because he knows what he is missing.

The old fool has got it all upside down. The one-eyed man, the Arimasp, is if anything more complete, precisely because he knows what he is missing. He has been to the edge of the pit, and therefore he knows what lies inside.

This may sometimes lead to some unease, a certain nervousness. Modern life is spasmodically punctuated by flickering electric lights and popping flashbulbs. At such moments I must always stop to check that it is indeed an external event and not something unpleasant happening in my remaining eye. I cannot forget the occasion when, shortly after the operation, I was at a friend's house in the country, there was a snowstorm, and when I poked my head out of the window in the morning there was nothing but an unbounded expanse of white with, in the foreground, three identical deck chairs. For one panicky minute I was convinced that my eye had been transformed into a bay window and that I would thenceforward see everything triple.

But neither can I forget the last time the bandages came off and I was convinced that one eye at least had been saved. For countless days and tranquilized nights I had been in darkness, free to "see" what I wanted or what some unknown programmer in the brain wanted for me. When I opened my eye to the world of light, the panorama was not very rich: a couple of struts and wires and tubing and a blank whitish expanse of hospital ceiling. But it was so gloriously precise, orderly, everything in its appointed place.

After the chaos of the dark, here was the army of unalterable law. It was a profoundly comforting experience. And, ever since, it has seemed to me that every line in nature—that "firm and determinate outline" which Blake saw bounding all things—is a little sharper, every color a little clearer, than it ever was before. I believe all of us who have lost one eye have shared this feeling. It permits us a certain sense of superiority over the ordinary herd of the double-eyed who are unaware of their extraordinary luck and let all these riches of the visible world slip by half-noticed. We are indeed more complete than they. Despite all the growlings of the griffins, the Arimasp gets the gold in the end.

In theatrical eye patch, actress Katharine Cornell portrayed Ana de Mendoza in 1949 play, *That Lady.*

Ana de Mendoza's silk eye patch added to air of beauty and mystery she lent the 16th-century Spanish court.

THIS IS AN AD FOR PEOPLE WHO THINK ALL THE LITTLE COUNTRY INNS ARE IN OTHER PEOPLE'S COUNTRIES.

They seem to have been lifted, setting and all, out of some other place. The French countryside, an English village, the Swiss Alps.

North Carolina's country inns. You see them standing tall on the mountaintops, tucked into green and yellow valleys, set back in the trees beside a winding road.

And, while the feeling may be European, the hospitality is strictly Southern. One innkeeper says it's "like having company all the time."

You'll find fresh flowers and four-poster beds. Music boxes and dinner bells. Long tables loaded with steaming platters of home-grown, home-cooked food.

And outside your window, and off the wide verandahs, scenery like you thought you could only find on picture postcards.

The famous and the obscure have warmed themselves at the great stone fireplaces of the inns. Aaron Burr. John C. Calhoun. Woodrow Wilson. F. Scott Fitzgerald. William Jennings Bryan.

George Washington never slept at any of them, of course. But Cornwallis (a gentleman who reportedly caused him to lose quite a bit of sleep) did.

The inns, in a way, are North Carolina in miniature. Because the warmth

of the people, the reverence for nature, the deep sense of history, are everywhere you go. Everywhere the inns are. From the mountains to the sea.

So come, this year. Bring your camera, your heartiest appetite, and your comfortable shoes. And spend your vacation in a fascinating country. Yours.

For a listing of North Carolina's inns and other accommodations, and a package of free booklets to help you plan your next vacation, write North Carolina Travel, Department 393, Raleigh, N.C. 27699.

NORTH CAROLINA

By Edwards Park

Imperiled species live and multiply in breeding refuge

An old Army remount station at Front Royal is home to strange Smithsonian animals, birds, in the abundance of Virginia's Blue Ridge

Jim Murtaugh/National Zoo

From gamboling foal (above, center) to sedate elders, Grant's zebras are mammals for all seasons. These

African ungulates tolerate powdery snow in Virginia's mountain scene, but when it crusts must avoid it

To get from the village of Flint Hill, at the edge of Virginia's Blue Ridge Mountains, to Front Royal, you take Route 522. It's a pleasantly scenic two-lane highway. You tool along mostly downhill—Front Royal is in a valley—and your eyes are half aware of hill farms with rolling pastures beside the road. Animals graze in lush grass as you whine past: a scattering of beef cattle, a pair of horses, a herd of dairy cows, some zebras.

Zebras?

At exactly that point on Route 522 there are skid marks, and you will probably add to them. But do not doubt your sanity. You are passing the Smithsonian Institution's Conservation and Research Center, a 3,200-acre facility for the care and study and breeding of exotic birds and animals, most of them endangered. This marvelous expanse of rolling land, the hills humping up to 1,800 feet above sea level, the glades refreshed by mountain creeks, is an annex to the National Zoological Park in Washington—an annex that's 19 times bigger, 85 miles distant and not open to the casual passerby, who has probably just left those skid marks. Here are born the babies of bird and mammal species that might otherwise not make it into this world. Here they are given environments that are supposed to suit each species to a tee. The small mammals and carnivores, presently eight species, have indoor quarters in long, spotlessly clean barns. The eight species of ungulates (hoofed animals) roam fenced paddocks varying in size from more than 40 acres to fewer than six. Here they have room to carry out their mating rituals in privacy and can bear their young into a welcoming world—clean, quiet, abundant.

If you left your car to peer over the fence at the zebras, you would see up to three foals, born last year, still tending to stick to their mothers. They keep close to the maternal flank for some months, but the Front Royal people have noticed that the mothers allow the youngsters to wander off if all three go together.

What is the origin of this beautiful zebra nursery, this home where the European bison roam and the Père David's deer and scimitar-horned oryx play? Until 1911 it was a collection of 40-odd private farms, some of them settled in Revolutionary War times.

The valley situation lured the railroad. In the Civil

to keep from cutting their feet. Lacking insulating coats, they spend most of winter season indoors.

Color photographs by Fred J. Maroon

War, troops of both sides passed through the area. Stonewall Jackson led his Rebel troops in a secret march on the town in 1862, forcing them at a rate of 30 miles a day—so fast that they called themselves "Jackson's foot cavalry." There was a Yankee force encamped near the present Smithsonian property. The Confederates caught them by surprise and sent them skedaddling. Later, Confederate troops moved near the present property on their way to the invasion of Pennsylvania—which ended with the Battle of Gettysburg. Some of them may well have camped beside a spring-fed stream where onagers—the wild asses of northern Iran—now drink.

In 1911, the U.S. Army bought up the farms on this property and established a remount station for the cavalry, "Front Royal Remount Depot." The first buildings went up—wooden sheds, then tile and stucco warehouses and stables, all in a style that you might call "permanent G.I." as opposed to the soulless temporaries of both World Wars. The costs are a delight to survey in the old scrapbooks still on hand at the Center. Two Junior Officers' quarters, for example,

U.S. Army buildings, refurbished for the Institution, include the granary tower, now

At Front Royal in 1925, leisurely crowd of Post families and guests gathered at show ring, waiting for depot's finest horseflesh to be put through its paces. Motorcars were lined up in uniform file.

the commissary building for birds and animals.
The structure on hill, left rear, is for administration.

had a reception hall, living room, dining room, kitchen, pantry, three bedrooms, two baths, closets, porches and hallways. In 1915, that set the Army back $8,974 apiece. These buildings are now used for putting up visitors who come to the Center for meetings.

The remount station flourished. Horses and mules were bred and raised, and dapper young officers enjoyed the chance to visit the place for its social amenities. One of the most dapper was George S. Patton jr., later the fire-eating tank commander of World War II. Soon after the station opened, he dropped by. He had been assigned to Fort Myer, outside Washington, and since it proved to be a pretty social post, this very wealthy young officer decided he needed to beef up his stable of horses. He bought a thoroughbred in Kentucky. Subsequently, he looked over the crop at Front Royal and turned them down.

Later, Patton was assigned to Front Royal as a purchasing officer. But his friend General John J. Pershing had the order rescinded before it ever reached Patton. The year was 1917, and Pershing was on his way to France as Commander-in-Chief of the American

Expeditionary Force. He wanted young Patton along.

In World War II, a prisoner-of-war compound was opened near the top of one of the hills at Front Royal. German POWs lived in a compound where temporary buildings were built on concrete slabs. Though almost all of the remount buildings—the granary, the barns, the colt stables, the riding hall—remain and are still used by the Smithsonian, nothing is left of the POW camp except those slabs, high on a hill, smooth concrete floors with electrical outlet cables thrusting through them. You may search for a bit of German graffiti—"*Hans ist da gewesen*"—but you'll find nothing. They say one POW painted a mural in the house of an American officer. A nice piece of art, they say, which got destroyed.

It must have been an unexpected experience for the prisoners: air like champagne, tumultuous birdsong, changing light on the misty hills and mysterious valleys of the Blue Ridge, cool nights, silent except for the occasional hoot of an owl. Little wonder that a few years ago one of them came back to see the place—an old grad visiting a rather strange alma mater. How many G.I.s who sat out part of the war in the same situation have gone back to see their good old stalag?

At the end of World War II it was evident that the U.S. Cavalry consisted of tanks, not horses. The property was reassigned to the Department of Agriculture, and, working with Virginia Polytechnic Institute, procedures in better breeding techniques for beef cattle were tested. During the icy depths of the Cold War, in the 1950s, a couple of the G.I. buildings were turned into high security hideaways. You can still see, in Building 28, the massive cable that brought current in to little cubicles where, apparently, decoding machines hummed away. The inner door is a safe door, the walls are soundproof.

Building 28 was a communications center for the

Wary male muntjac, a Chinese barking deer, stares suspiciously, braced to turn and bolt.

Another muntjac hides under ornamental grass planted especially to give species some cover.

These small deer require such protection and seek it out, hating to be caught in the open.

Wisent, or European bison, gorge on the summer's bounty in their high pasture at Front Royal.

Adapted to forest life, wisent are narrower, taller than North America's *Bison bison.*

State Department from 1952 to 1964, and government biggies came and went. Among them was President Eisenhower—but only to look at the Black Angus grazing in the pastures. Old-time maintenance men still working at the Center recall that during the Cuban missile crisis phones were tied directly from this little high-security enclave to the White House.

The Department of Agriculture held the Front Royal property until the Smithsonian took it over in 1974. That year the first two species of ungulates were introduced into fenced pastures at Front Royal. They were scimitar-horned oryx, highly endangered in their native Sahel, south of the Sahara, and Père David's deer which had long been extinct in the wild when a Basque missionary to China, Père Armand David, discovered some in the Imperial game park near Beijing (Peking) in 1865.

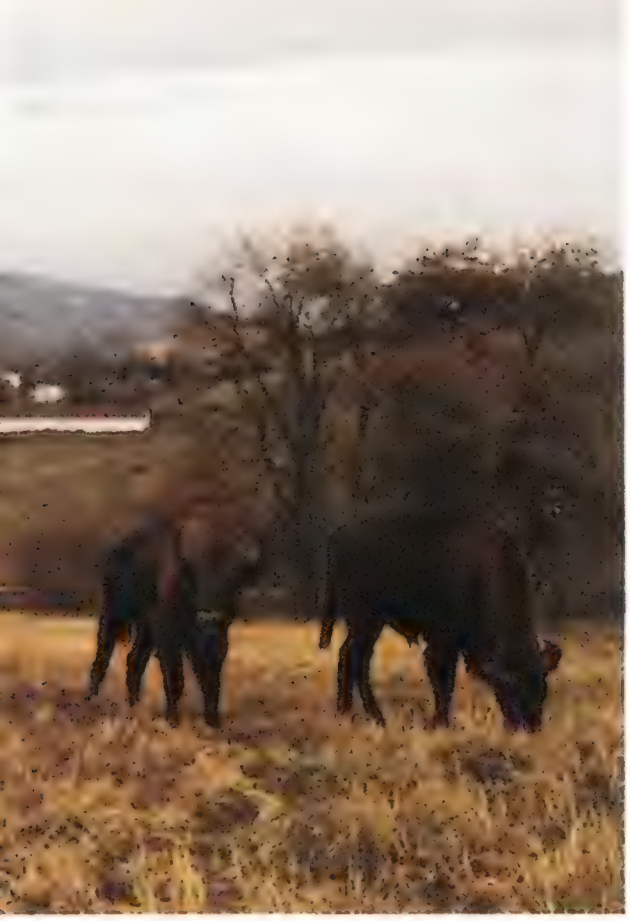
These species prospered. Today there are six other ungulate species at the Center. The zebras roam a paddock that comes close to the highway. So do the Bactrian camels; if you drive by on a cold, snowy day, you may see them near the road. They love the cold and seek it out—often on the highest ground they can find, where the air is crispest. In summer they make do with the shade of their open barn.

Rather shy and secluded are the wisent, European bison that were once widespread across the Continent, but now survive only in zoos and preserves (SMITHSONIAN, May 1978). Eld's deer, originally from Southeast Asia, are also a retiring lot, sticking to underbrush, hard to see. They share the same paddock as the zebras, but will move into their own custom-designed yards this spring. Onagers, on the other hand, feel that they own the place. They dash confidently around their broad pastures, curious about human visitors, the stallions so ready for an instant quarrel with male zebras that the two species can't have adjoining paddocks. Finally, there are the little muntjac, Asiatic barking deer, primitive members of the family with well-developed canine teeth. They don't need much room, and their enclosure contains a watchtower from which scientists can study them. One bit of research, for example, has concerned their barking. It seems to be brought about only by unidentified danger—but, oddly, when one muntjac barks, others apparently pay little attention.

The scientists at the Center have learned about the grazing habits of the hoofed stock and can now adjust correct numbers of animals to various acreages without resorting to guesswork. Curator-in-charge Christen Wemmer has noted that making grazing judgments based on knowledge of horses—as the staff had to at first—would have left zebras, for example, snuffling around a pasture as barren as the recess yard of an inner-city school.

Winter months are breeding time for the Bactrian camels. Rutting males are so aggressive that only one at a time is allowed to join the ladies. The aggression even rubs off on adolescent males. They nip at their copulating elders. In a real showdown, camels "wrestle" with their long necks, one trying to get his neck on top of his rival's and, by pressing down, bring him to his knees.

Love play toward the females is a sort of messy business. The male urinates on his own tail, then slaps it over his rear hump and, says Larry Collins, curator



Seed herd (above, in autumn) is being assembled from animals sent by other zoos.

Wisent can cope with Virginia's cold, will paw snow to get at forage, but acorns are their favorite food.

of mammals, "it's a lot more effective than after-shave lotion." (He also throws back his head and anoints his front hump with oil secreted by his occipital gland.)

For a few years the Front Royal herd was headed by Humphrey the impotent camel. However, he didn't seem to know it, always acting the alpha male. Humphrey has left to become the family pet of a wealthy Texan.

Gestation takes 13 months, so camel calves started a year ago will be born next month in the depth of the winter that these Bactrians find so delightful. The maned wolves, however, will be producing pups this month. Originally from South America, they are extremely shy, more fox than wolf, and hard to raise in captivity. If the mother is disturbed while with her babies she may neglect them and consequently they might not survive. To cope with this problem, a TV camera is set up in the enclosure so that keepers can monitor the animals from a distance. Three litters have been produced under this system.

Collins says that 1979 was a big year for mammals at the Center. For one thing, lesser pandas produced young. These small tree climbers can be very friendly with humans. Although two of the youngsters needed supplemental feeding, the temptation to hand-rear them was resisted in favor of keeping them with their parents and siblings so that, in Collins' words, "they wouldn't turn into little people."

Crab-eating foxes, also from South America, have reproduced so well at Front Royal that some males have had to undergo vasectomy. Nine of this species are surplus and up for sale. In fact, the breeding aspect of the Center is so successful that a number of animals raised there are now advertised for sale to other zoos.

The binturong named Boe has had a baby named Arroe. Binturongs are nocturnal Asian tree dwellers, rather affectionate with humans (that is, if the humans can stand their smell, which may most indulgently be described as "hearty") and certainly adoring parents. Boe—her name is an acronym for Buffalo One Eye, and God knows what *that* means—simply looks blissful while Arroe walks over her and bounces on her stomach.

The golden lion marmosets, those neon-orange little monkeys that seem to go through life in a state of neurosis brought about by endless conflict between cowardice and curiosity, are effective breeders. One female bore two consecutive litters of triplets and raised them all. Of course, marmosets have the sensible habit of parceling out infant-rearing chores to other members of the family. Dad looks after the kids when Mom doesn't want to. Older siblings help.

The clouded leopards, on the other hand, have disappointed. There are three males and one big-eyed, slinky female. She came into heat last year, but nothing happened except a lot of heightened aggression among her potential mates. And since clouded leopards are notorious wife-beaters, the Zoo staff thinks it will try artificial insemination.

Guy Greenwell, curator of birds, has been preparing yards for the hardy groups—such as pheasants—that can get through a Virginia mountain winter. Four species of cranes are flourishing; huge flightless Darwin's rheas and emus share paddocks with ungulates. More delicate birds are quartered in the renovated army stables.

Front Royal's marvelous Center

One of the housekeeping problems at Front Royal is the covering of bird pens. Wire roofing must keep birds in, keep predatory great horned owls out, finally allow snow to pass through without piling up on top and breaking down the pens. Nature is seldom mild.

The problem of native animals requires a good deal of ingenuity. White-tailed deer are plentiful—and highly curious about the strange foreigners that have taken over so much good grazing. High fences help keep them out, and gates turn them back with a slight electrical shock as do flapping ribbons which discourage jumping. Little sacks of blood meal are supposed to keep deer from valuable trees. You see these sacks frequently.

But you also see deer frequently—enough so that the sight of a distant ungulate makes you run through the possibilities: Eld's deer? Père David's? No, whitetail. You may see them just outside a fence, gazing in, with what may be wistfulness. On the other side is the placid herd of Père David's deer, resting, blinking in the sun, sometimes competing restlessly for a favored spot, two females forehead to forehead, ears laid back. The whitetails seem to watch with interest. As long as you stay in your jeep, all the animals ignore you. Get out, and both the exotics and the natives run.

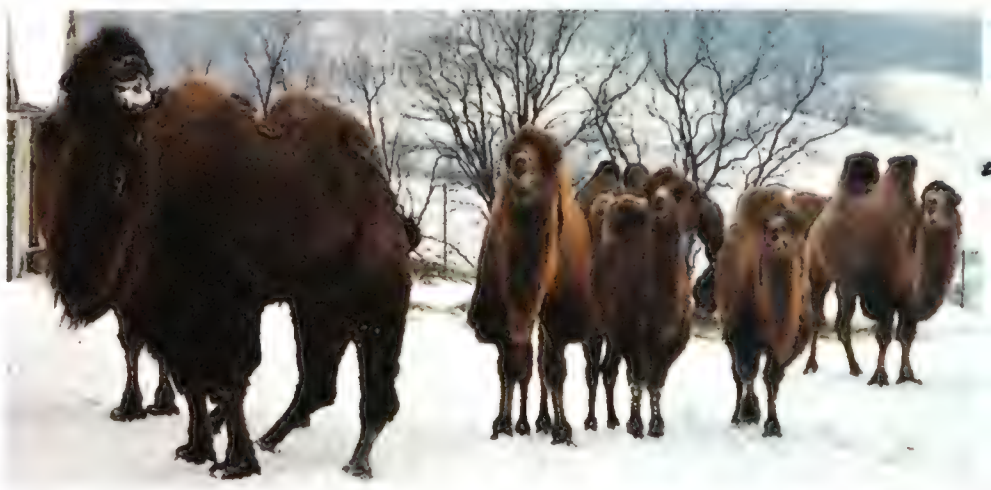
Working at the Center requires that knack for improvisation that farm life calls for. If something goes wrong, you fix it. If you need something that doesn't exist, you make it. To a large extent the Center raises its own hay for winter feed. A project to set out beehives and produce enough honey just for the Zoo fell flat. Some 60 hives were established and then the native bears got at them and cleaned them out.

Larry Collins, a volunteer fireman at one point in his career, has set up a company in the Center, using an existing shed already labeled "Company 7." With minimum expenditure, Larry liberated two old trucks, had them equipped with water tanks, pumps and hoses. The outfit is hooked into the Warren County alarm system and has its own "tones" that send employees hurtling into action.

No visitors' center—once suggested—has yet been established at Front Royal, and casual callers are not allowed. But the Smithsonian Associates and Friends of the National Zoo arrange trips to the Center occasionally, for the place has much to offer besides the excitement of these animal and bird residents.

After a day or so, your mind becomes overloaded with it all. As you drive off, past the old hill farms, you see grazing animals again. "Wisent?" you ask yourself. "Onager? Eld's deer?" Then you snap out of it. A dairy cow is what you're looking at.

Père David's deer, macho males, spar in late summer. Beelzebub, left, is seven; Faust, at right, is two.



Bactrian camels gather in rutting season. Males grind teeth, which makes them froth at the mouth (left).

Odd couple—the female emu, Australia's national bird, reared 27 chicks in 1979; the Eld's deer yearling is in velvet.

Fill in your Beethoven

Romantics

236653. Berlioz: Symphonie Fantastique—Bernstein, New York Phil. (Columbia)

283846. Bizet: Symphony in C; Mendelssohn: Symphony No. 4 (Italian)—Stokowski, National Sym Orchestra (Columbia)

285049-285040. Borodin: The Three Symphonies; Overture and Polovetsian Dances from "Prince Igor"—Andrew Davis conducts the Toronto Symphony in highly praised performances of these exotic scores (Counts as 2—Columbia)

296806. Bruch: Violin Concerto No. 1: Lalo: Symphonie Espagnole—Pinchas Zukerman; Mehta, Los Angeles Phil. (Columbia)†

276808. Dvorak: Symphony No. 7—Giulini conducting London Symphony (Angel)

230433. Dvorak: Symphony No. 9 (New World)—Bernstein conducts New York Phil. (Columbia)

262337. Elgar: Symphony No. 2—Solti and the London Philharmonic (London)*

230417. Franck: Symphony in D Minor—Bernstein, New York Phil. (Columbia)†

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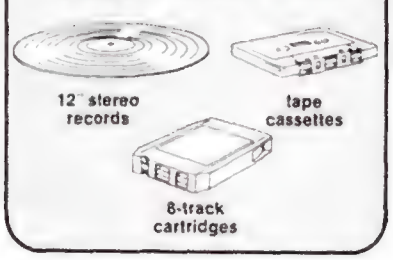

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As a streak is formed by the headlights of passing motorists on Interstate 80, two swordsmen duel.

By J. Fritz Lanham

The result is mad when urban wastes become public art

Artists and ordinary people find an outdoor gallery for their imaginative sculpture on a California mud flat

Driftwood, old tires, rusty cans and other debris float across San Francisco Bay, driven eastward by the winds, and wash ashore on a marshy strip of land that lies next to Interstate 80 bordering the East Bay, an area known as the Emeryville mud flats.

For 17 years now, artists and just ordinary people have been going out to the mud flats and nailing together this unpromising stuff, the refuse of man and nature, to make whimsical sculptures. They build trains and ballerinas, chickens and totem poles, whales and airplanes—whatever the materials, the locale and human ingenuity suggest. Some of the pieces are skillfully done; others are quite crude. Some manage to remain standing for a year or two; others last only a few days before succumbing to the winds or the tides or the hand of another artist who needs the material for his own work. Almost all are done anonymously. All for the sheer fun of it. The result is an outdoor gallery of pop art. The thousands of motorists who daily drive the nearby freeway provide the audience.

Photographs by Douglas Keister

This aluminum-can fish inspired photographer Keister to take a time exposure of car headlights reflected off the "scales." Then, for the second exposure, he used a red filter and set off a flash inside the fish.

The consensus has it that the first mud-flat sculpture was built in 1962 by John McCracken, a student at the California College of Arts and Crafts in Oakland. McCracken, the story goes, was inspired by a class of CCAC students who built a driftwood sculpture on nearby Bay Farm Island in an experiment to explore the question of whether such "junk art" is really Art with a capital A. The area McCracken chose, the Emeryville mud flats, had been on the edge of a well-known amusement park at the turn of the century. In the 1920s the park had been leveled to make room for industry; and in 1954 the freeway cutting along the bay was completed, leaving only a half-mile-long, 100-yard-wide strip between the water and encroaching urban development. Whatever it was that McCracken built vanished long ago, but the idea caught on, and nowadays from 50 to 100 sculptures line the flats at any one time.

The locale itself seems to inspire many of the artists. Gulls wheel in from the bay and feed along the shoreline, which somehow prompts someone to nail 16 small pieces of driftwood together and wire the thing to a pole stuck in the mud near the water. And now the living birds have a sculpted companion, perhaps a tern frozen in a graceful dive for some morsel. The sailboats and tugboats that ply the bay inspire other artists, and fish are a popular subject.

Animals are a popular motif, especially large animals, and the area always has the look of an exotic menagerie, with kangaroos, giant lizards, camels, chickens, horses, eagles and creatures of indeterminable kind strewn across the landscape. In part, animals may be popular because they can be done in two dimensions, as silhouettes. But again it may be the mud flats themselves—fetid, half land, half water—that inspire sculptors, reminding them of primordial times. At one end of the flats a ten-foot-high tyrannosaur

Free-lance writer Lanham and photographer Keister live in Oakland, a few blocks from the mud flats.

Public sculpture at Emeryville mud flats

squares off against an equal-sized triceratops, the latter an especially admirable piece because it is done in three dimensions, with more than 50 pieces of driftwood forming its crest and pointed snout. And there's something evocative about the presence of one of the most imposing pieces, a long, sinuous dragon, its jaws locked open in a perpetual threat, whose hubcap eye stares out balefully at passing motorists. On the mud flats even a chicken, when it's 12 feet tall, takes on a fantastic, archaic quality.

Indian motifs also are common, which is appropriate because for hundreds of years the area was a fishing ground for the Costanoan Indians. Totem poles appear with regularity.

Complementing traditional subjects are more topical pieces. The movie *Star Wars* inspired a head of Darth Vader, and not long after the King Tutankhamun exhibit arrived in San Francisco, predictably, a sculpture of his gold mask appeared. The latter is a fine, sturdy work, standing nearly ten feet tall and painted green and gold. Mismatched hubcaps serve nicely for eyes, blue-painted strips of tire rubber for a beard, a string of crushed beer cans for a necklace, and (until recently) a half-circle of pink plywood bisected by a broken fan belt for a mouth. The boy king has a somewhat quizzical, melancholy expression. The proud artists, all six of them, have signed their piece, a rarity on the mud flats.

Most of the sculptures are representational, but there are also lots of quirky, indecipherable pieces, expressions of some private vision. One such creation, hardly visible from the freeway, consists of a large forked tree branch painted black and stuck into the ground. Wine bottle necks and a child's rocking horse dangle from the branches, suspended by rope, while nearby sit two wooden figures with Styrofoam heads, painted bodies and little tufts of grass for hair. The whole piece seems deliberately to suggest some obscure allegory. Many others seem to have been slapped together just to say "Hi-I-was-here." And sometimes it's difficult to know whether a sculpture was intended to be abstract or has simply started to fall apart.

But whatever a mud-flat artist chooses to create, and however skillful or inept he may be, he builds exuberantly, inventively, and this is what gives the phenomenon its appeal.

"You feel like a kid with a chunk of clay," says Walt Zucker, a genial 46-year-old Oakland artist who has built a dozen sculptures on the mud flats over the last two years. "You can just start making something—the materials are free and there's no pressure to produce or exhibit. I was going out there almost every day at one time, and my mind was teeming with ideas. I was able to slam a few boards together and then move to something else." He seldom goes out with the idea of something specific in mind, he explains. It's the spontaneity of mud-flat art that appeals to him. "I'll see a pole sticking out of the ground and say to myself 'a shark would look good on that,' or I'll see a piece of wood and it will remind me of a bird." On the other hand, he built one of his most elegant pieces, a ballerina, because he was working at the time on publicity for the Oakland Ballet Guild.

Walt likes to erect tall pieces. His works have included a 38-foot giraffe and an 18-foot bird, both made of long, half-rotted lengths of wood, and a shark mounted on a tall pole. Because his sculptures are tall and delicate, they seldom last long. His giraffe stood for only a month, his bird didn't last that long. His ballerina did stand for the better part of a year, but

With periodic face-lifts, the popular "Mudflat Express" is still standing after two years.

then it, too, collapsed. Someone reerected it, but now it's down for good—everything but the head and legs has disappeared. Walt can point to a heap of wood here—his bird; a heap of wood there—his shark; and can show you a bare patch of ground where another of his pieces stood at one time. Understandably, he betrays a trace of regret when kicking over the remains of his fallen sculptures, but he's philosophical. Change is the essence of the place.

That seems unfortunate sometimes. It's a disappointment to drive by and discover that a personal favorite is lacking its head or is gone altogether. And it's irritating to realize that simple vandalism is often

San Francisco Bay and Marin County form backdrop for windmill paired with a free-form "beak" (right).

Disparate themes find common ground on mud flats as Indian warrior faces a working windmill.

the cause. But of course the materials are ultimately recycled into new sculptures, and knowing that yesterday's mediocre sea gull may become a first-rate flutist tomorrow is some consolation.

"Mud-flat art isn't anyone's personal property, and that's good," says Nora Bendich, a 23-year-old Berkeley artist who built her first sculpture on the mud flats when she was six. Nora created "Mona and Merv" (see p. 91) by cutting the figures out of Masonite and then painting them in bright colors. Having concluded that she was unable to live with them in her home, Nora placed them on the mud flats last January. Mona, missing a few limbs, hangs on to life. But Merv is now gone altogether except for his leg, which someone decided would look good protruding from the nearby dragon's mouth. But, says Nora, "it's okay the way Merv's leg was used, because it was incorporated into another work. I love when someone does that."

That a mud-flat artist feels free to add to an existing piece or even recycle an old work into a new one is a virtue, Nora believes, because it's important for art to be accessible. A lot of people think that art is something heavy and somber and that works of art are sacred and can't be touched. High art has become a very esoteric thing, removed from society. But art should be outside, not just in galleries. The great thing about the mud-flat art is that everybody can understand it, and everybody gets a chance to fool around out there. All it requires is a lively imagination and a happy spirit.

Indeed, more and more people seem to be indulging their creative urges on the mud flats, and some changes are taking place. Paint is appearing with greater frequency. And to the dismay of purists, some artists are now bringing materials out to the mud flats rather than using only what the tides supply. Some, like Nora Bendich, even assemble their pieces elsewhere.

The future of the mud flats isn't entirely clear. The Santa Fe Land Improvement Company, which owns the property, professes no plans at present to either develop or sell it, and tolerates the mud-flat artists mainly because preventing the trespassing would be more trouble than it's worth. What complicates the matter is that the area is a feeding and nesting ground for dozens of species of birds, including the California brown pelican and the California clapper rail, both endangered species; the area is also the only regular stopover site on the Pacific Coast for the Arctic tern

during its migration to the southern hemisphere. This has led to a proposal that the land be declared a wildlife area, which would probably mean some restrictions on sculpture building.

So the drive-through art gallery on the Emeryville mud flats will undoubtedly continue to thrive, the exhibits always changing, to the satisfaction of both the commuter stuck in the snarl of morning traffic and the amateur artist yearning to try his hand at building a roadrunner or a pair of dueling swordsmen. And to the satisfaction of photographers like Douglas Keister, who, with the mud-flat artists themselves, takes what he finds there and makes of it something delightful and new. But, if there is a jury, it is still out on whether this art has a capital A.

While driving toward Bay Bridge, motorists see roadrunner with a hubcap eye seeming to keep pace.

The garish forms of "Mona and Merv" (opposite) lasted a few months before being partially dismantled.

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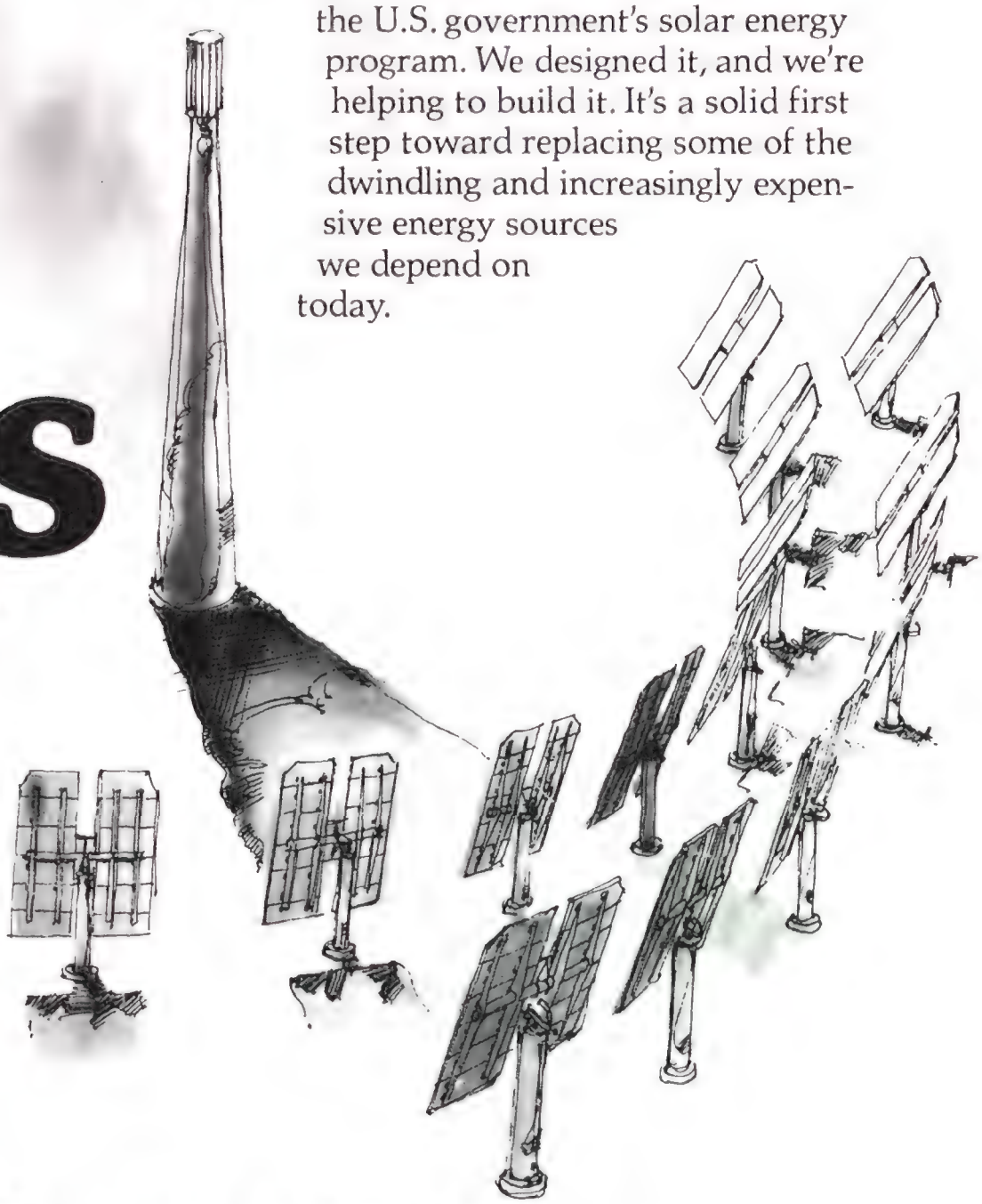

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By Cassandra Tate

Ambivalent TVA roles in energy and conservation

It once fought poverty with hydroelectricity and is now using smoky coal and nukes—plus trying out solar power and synthetic fuels

The cab stops in front of a tiny plaza squeezed between two stark, formidable cubes of concrete and glass, which are regarded as the ugliest buildings in Knoxville, Tennessee. Inside are the main offices of the Tennessee Valley Authority. The TVA, the driver says, has something to do with electricity; they run ads on TV saying turn your heat down, turn your lights off, that sort of thing, but nine times out of ten, you look over here and all *their* lights are on. He remembers TVA got started during the Depression and bought up a lot of land and built a lot of dams and did things for farmers. He's not sure what all they do anymore, but they've got these two big buildings with a great plenty of people running in and out all day long. They must be up to something.

TVA is a regional development corporation owned by the people of the United States, and ignored by most of them. The corporation manages a 652-mile waterway regulated by 34 dams, employs about 47,000 people, owns 1.3 million acres, has some $11.6 billion in total assets and conducts a variety of social and economic development programs. It operates the nation's largest power program, generating electricity for almost all of Tennessee and parts of Kentucky, West Virginia, North Carolina, Georgia, Alabama and Mississippi. It's the nation's largest purchaser of coal.

Cassandra Tate, former Nieman Fellow at Harvard, wrote for the Lewiston Morning Tribune *in Idaho. She is now a free-lance writer living in Seattle.*

Workers lined up in this classic Lewis Hine photo were hired to construct the first of TVA's many dams.

Present-day TVA workers in Knoxville enjoy a lunch concert in view of the agency's twin 12-story towers.

It is not the largest polluter, but it does come close.

It is, furthermore, an old dream, dull and flabby, reaching for rejuvenation. Today it is trying—in sometimes halting and ambiguous ways—to transform itself from an ardent promoter of electrical power to a fervent experimenter in all kinds of energy conservation and production.

The Tennessee Valley Authority was born in 1933 in a burst of unrestrained hope and mighty ambitions. It was supposed to be a model land-use and social-planning agency, teaching not just the Tennessee Valley but the world how to use natural resources wisely and well. Franklin D. Roosevelt was for it. Woody Guthrie was for it. Private power was against it, as were the coal companies (who feared electricity from TVA dams would destroy the market for coal-fired power); conservative politicians (who feared TVA would build up its region at the expense of theirs); and the business establishment (which saw in TVA the hand of Creeping Socialism). Within a generation, TVA's strongest allies were private power, the coal companies, conservative politicians and the business establishment. An agency which began life playing kickball with the liberals finally waddled off to the golf course with the conservatives.

By the time the twin towers were completed in 1976, more than half the sulfur-dioxide pollution in the Southeast and 12 percent of that in the country as a whole was coming from TVA power plants. Industry efforts to weaken federal clean-air laws were being led by TVA. The agency was proceeding at a furious, round-the-clock pace to complete Tellico Dam despite evidence it would wipe out an endangered fish.

The environmentalists take charge

TVA's leaders at the time believed the production of cheap power took precedence over compliance with what they regarded as excessive environmental-protection laws. That conviction put them at odds with a perhaps small but influential group of people, not the least of whom was President Jimmy Carter. In August of 1977, after complaining that TVA had become "just another power company," Carter appointed S. David Freeman—a determined conservationist who previously headed the Ford Foundation Energy Policy Project—to its three-person board of directors. Nine months later, longtime Chairman Aubrey J. Wagner retired and Director William L. Jenkins resigned, saying he felt harassed by the environmentalists. Freeman, 53, was named chairman. He was joined after six months by Richard M. Freeman, 58, a Chicago railroad executive to whom he is related philosophically but not otherwise. Robert N. Clement, 36, former Democratic gubernatorial candidate and former chairman of the

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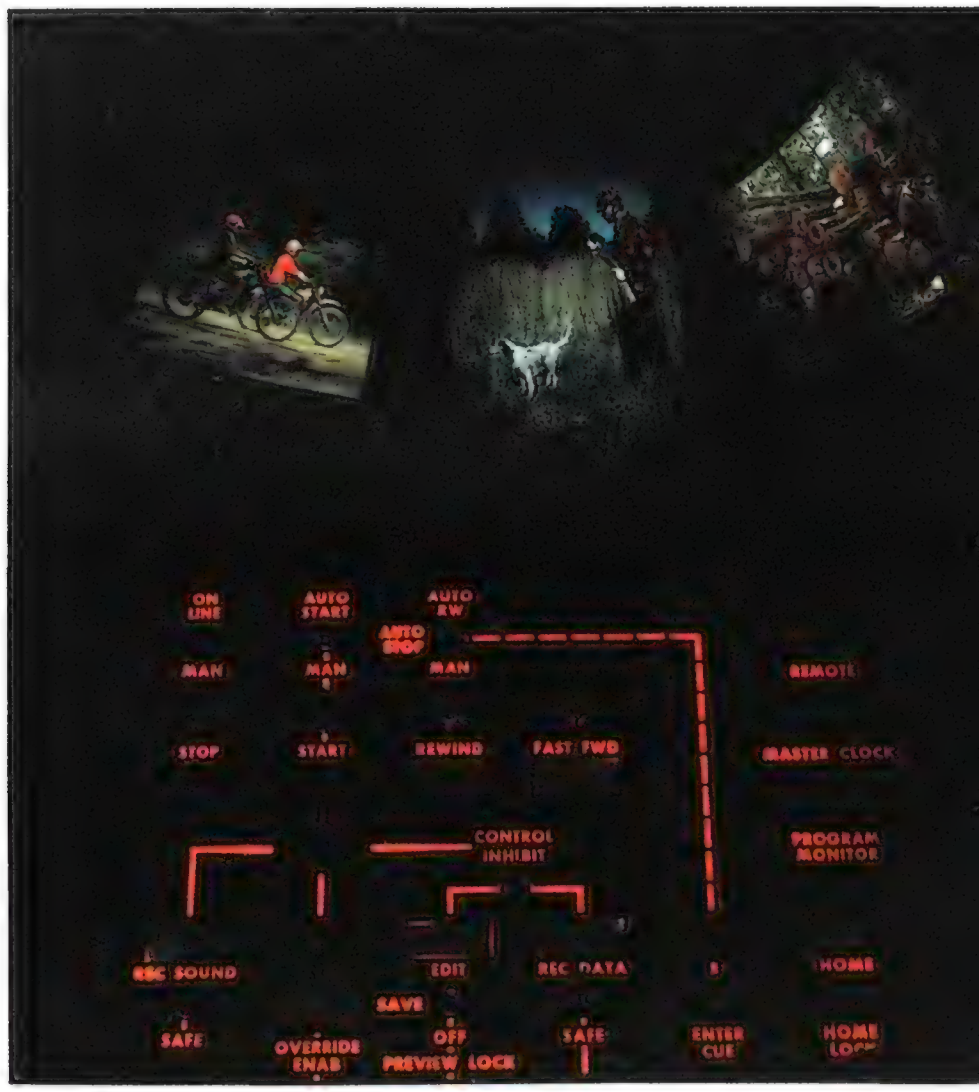
Color photographs by Dan McCoy

Pre-TVA impoverishment of land and people in Valley was documented in this stark image, made in 1939 in Sevier County by one of TVA's photographers to publicize soil conservation and power programs.



Promotional slide show at a public information center displays some of TVA's contributions to the region.

Tennessee Public Service Commission, was appointed in August to complete Jenkins' term.

The farewell parties had scarcely ended before the new order began making its presence known. TVA had been charged with chronic violation of federal clean-air laws in a suit filed in 1977 by the Environmental Protection Agency, the states of Alabama and Kentucky and a coalition of environmental groups. In one of his first actions as board member, David Freeman negotiated a settlement involving the installation of about $1 billion worth of pollution-control equipment at ten of TVA's 12 coal-fired power plants. The settlement has been stalled in the courts, however, since several rural and municipal distributors of TVA power intervened to block it, claiming it would cost too much. There was also the fuss over the little fish and the big dam.

The snail darter is a three-inch snail-eating fish of nondescript configuration whose purpose in the grand scheme of things is obscure and which was itself unknown until 1973, when a zoologist named David Etnier discovered it swimming in the Little Tennessee River seven miles above the half-finished Tellico Dam.

Etnier, a muscular, cigar-smoking professor at the University of Tennessee in Knoxville, was not an entirely disinterested scientist when he found the snail darter. He was one of a growing number of people who opposed the dam, on the grounds that it would destroy one of the last free-flowing rivers in the region and generate only $3 million worth of electricity a year after inundating prime farmland capable of producing $8 to $24 million worth of food a year (this issue is getting more and more exposure, even today). The water behind the dam would also destroy the homeland of the Cherokee Indian Nation. He notified TVA of his discovery. "They just shrugged it off," he says.

In 1977, with the dam 90 percent complete, a federal appeals court ruled it would destroy the only habitat of an endangered species, in clear violation of the Endangered Species Act. The Supreme Court and a special cabinet-level committee subsequently agreed.

The TVA under Wagner refused to consider seriously the possibility of not completing the dam, which had been planned for the Valley as early as 1936. Freeman considered the unthinkable, ordering a staff report on the alternatives. These ranged from tearing down the dam altogether to maintaining it for use only during floods. But he assiduously refused to say what he thought should be done. "I guess you can call me a coward on that one," he says. "We laid out the alternatives. Beyond that it was up to Congress."

In the end, Congress enacted special legislation exempting Tellico from the Endangered Species Act, President Carter signed it and, in November, the last residents in the reservoir area were evicted.

There are other signs of change at the TVA: new or greatly expanded programs to promote conservation; dozens of projects to test new energy technologies; an enlarged Office of Community Development; board meetings being held throughout the region; public hearings becoming the rule rather than the exception.

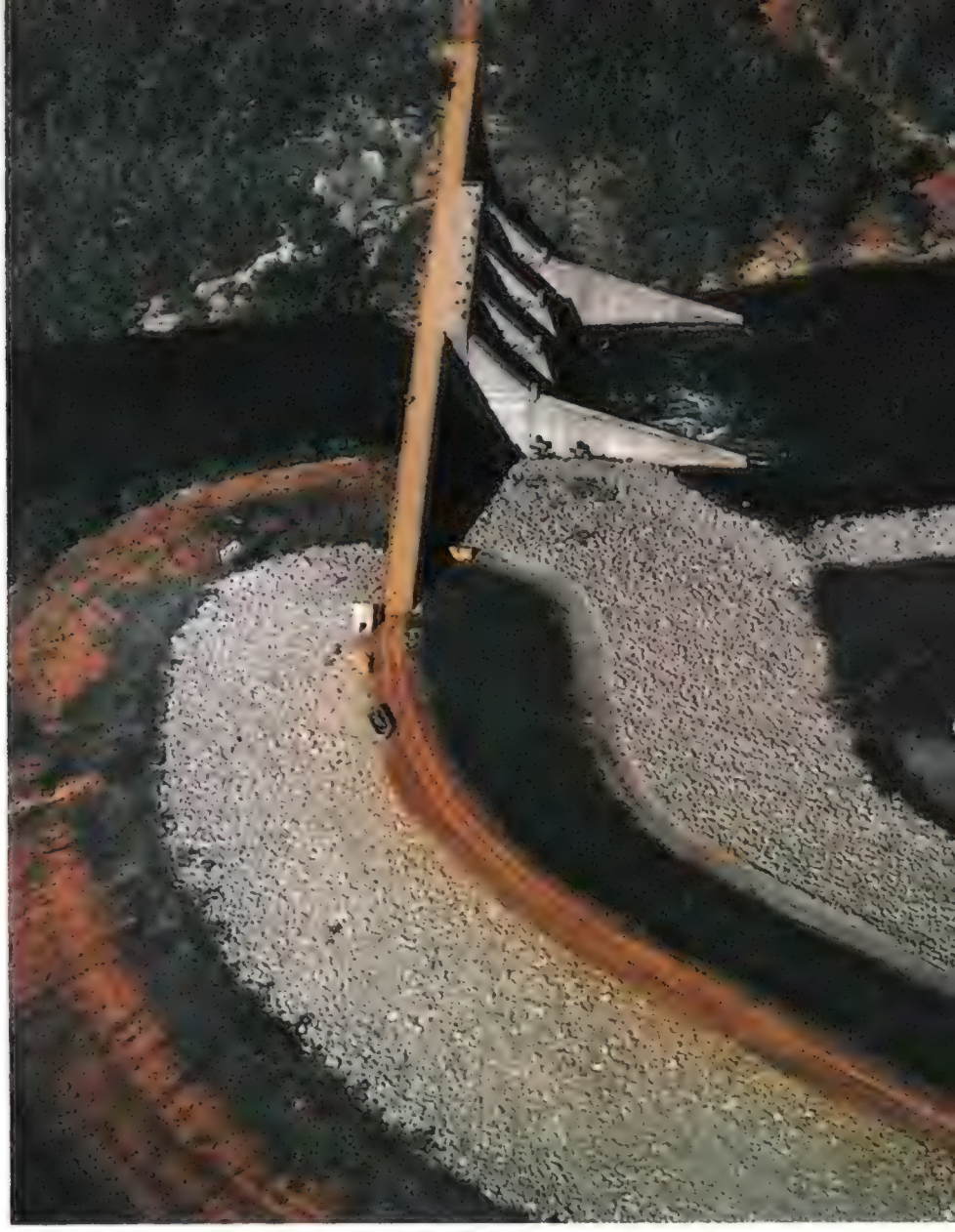
Ensconced in their Knoxville tower are the three new directors of TVA—from left, Richard M. Freeman, Chairman S. David Freeman, Robert N. Clement—seeking new energy sources and stressing conservation.

"It's an exciting time," says Freeman, sitting on the couch in his large corner office on top of the smaller TVA tower. "TVA's in a position to demonstrate, to act and not simply to preach, on the energy problem and also on the problems of how a region should grow. We've got challenges that are a bit more sophisticated now and may be more difficult to excite people about, but I think—and I realize this may sound self-serving—that we've got a more important role to play now than we had in the 1930s."

Just as the TVA's first chairman, David E. Lilienthal, was an outspoken critic of greedy private utilities in the 1940s, Freeman now speaks of Big Oil's "monstrous power" and "greed," and insists the industry is bent on "buying up America." TVA at his direction has filed lawsuits challenging certain oil company acquisitions of coal and uranium interests, and launched a legislative campaign to stop mergers. "One of the most serious and fundamental problems we have in this country is the oil industry's domination of coal and uranium and other resources," Freeman says. "You go to buy coal and find it's owned by an oil company. Go to buy uranium and it's owned by an oil company. The sun would be next if it were for sale."

At public hearing (more common under new directors) consumer advocate Bill Troy tells board what to do.

New order at TVA



The Tellico Dam, center of controversy, may be a last monument to TVA's 40-year dam-building spree.

TVA was originally established to promote "economic and social well-being" by the simultaneous (and it would later be said mutually exclusive) development and conservation of natural resources. This was to be done primarily by building dams for navigation and flood control, setting up soil conservation and reforestation projects and developing fertilizers. Surplus power produced by the dams was to be sold.

By the end of its second decade, TVA had girdled the Tennessee with 20 dams, turning an unruly river into a series of fat, phlegmatic reservoirs; reforested 212,000 acres; launched agriculture's "green revolution" with fertilizers developed in labs at Muscle Shoals, Alabama; set up soil-reclamation projects on 68,000 farms; and built several model towns, highways and industrial parks. And it had become the biggest electric-power producer in the country. Its home consumers were lapping up an average of twice as much electricity as their national counterparts—a pattern that continues today.

TVA revolutionized the power industry by selling electricity at rock-cheap prices and urging people to use it with abandon. The agency sponsored aggressive campaigns to promote power use, and pressured its distributors to do the same. "Load growth won't happen automatically," G. O. Wessenauer, manager of power at the time, told a group of distributors in 1959. "It will take hard work and it will give us aches and pains. But it will be worthwhile. We need that growth if we are to live as electric suppliers."

As a result of these efforts, "an increasingly well-off population found it highly desirable to heat electric, cook electric and do everything else electric," says Nat Caldwell, a veteran reporter for the Nashville *Tennessean*. "If there'd been an electric device for wiping your bottom, we'd have had 'em, and more of 'em, than anyplace in the world, right here."

The power program sucked most of the kilowatts from the river and demanded more. TVA fed it coal. The Cumberland Plateau became dirty with strip mines developed to supply power plants, with TVA the largest customer. Still the power program demanded more. TVA turned to the atom. Today one nuclear plant is in operation and six are under construction. By the end of the 1980s, TVA should be the nation's biggest producer of nuclear power.

"Becoming a big utility company was the most socially and environmentally disruptive thing TVA could have done," says Michael Clark, director of the public-interest Highlander Research and Education Center in New Market, Tennessee. "Their mining policies in the 1960s pioneered large-scale stripping. They began to destroy the land they were supposed to be protecting. It's amazing, but it happened. Then along came nuclear power, and they did the same thing. They said, 'Well, we gotta have power.' The implications of a continuous growth policy were not only not questioned, but were aggressively pursued."

The questions are being raised now by, among others, the new chairman of TVA. Simon David Freeman is a short, slender man, graying of hair and receding of hairline but looking younger than his 53

Zoology professor David Etnier discovered endangered snail darter, the fish that almost stopped Tellico Dam.

years. He lives alone in a condominium ten minutes from the TVA towers, on a bluff overlooking the Tennessee River and the city of Knoxville. An indifferent dresser, he has been known to show up at the theater in business suit and tennis shoes. He drives a 1970 Opel Kadett, which he bought secondhand for about $500. He's quick-faced, intense, sometimes abrasive; mightily disapproves of automobile air conditioning and snowmobiles; bites his nails but quips "I don't get ulcers, I give 'em!" He clearly enjoys what he is doing now. "I'm as happy a person as I know," he says. "But maybe I'm just caught up in my own rhetoric."

He was born in Chattanooga, the son of an Orthodox Jewish umbrella repairman who emigrated from Lithuania and settled in Tennessee, where the heavy rainfall helped produce the destructive floods Freeman saw every spring as a child, before TVA built its dams. His asthma was aggravated by smoke from the coal burned in home furnaces before TVA made electric heat a way of life in the Valley. "We had terrible air pollution in downtown Chattanooga because of the coal," he says. "You couldn't wear a white shirt for more than a couple of hours. The electric heat at least took the pollution out of downtown and out to the area around the power plants."

In 1961, after working as a TVA engineer for six years and then as a TVA lawyer for five, he left Tennessee to join the staff of the Federal Power Commission and later to serve as an energy adviser to President Carter. He left as "a great advocate of energy promotion." He came back convinced "we must get serious about conserving energy."

"I like to think I've changed when the facts have changed," he says.

Freeman speaks of conservation with intensity. It's the cheapest form of energy, he says; the most readily available; the surest way to protect the environment; a major weapon against inflation. "We're not talking about stunting economic growth," he insists. "It shouldn't take a PhD in economics to understand you create jobs when you invest in insulation and solar and other alternatives, and you get even more jobs per dollar than when you build a power plant. Conservation is often seen as an enemy of growth. Inflation is the real enemy. By saving energy we save money and cut down on the inflationary impact of higher and higher energy prices."

We are living in the dying days of petroleum, he says. Either we will move from profligacy to frugality or "we'll be a has-been civilization by the end of the 20th century."

The centerpiece of TVA's conservation efforts is a program offering no-interest loans of up to $2,000 to weatherize electrically heated houses. Another project involves the installation of solar water-heating systems, financed by TVA at low-interest rates. The resulting savings offset the monthly charge added to the power bills to cover loan payments and maintenance. From an initial 1,000 homes in Memphis, the program will be made available to 10,000 homes throughout the region next year—and up to 100,000 homes across the Valley eventually.

Using the sun, here and now

"The key leap here is commercialization instead of demonstration," says Travis Price, a young Knoxville architect who helped set up the project under contract to the TVA. "We're showing that you don't need to build a nuclear power plant to heat your water, you can let the sun do it, and you don't have to wait 20 years. It can be done here and now."

TVA also is providing interest-free loans for wood-heating stoves (SMITHSONIAN, October 1978) in north Georgia. The stoves are installed by private firms and inspected by representatives of TVA. Chimney emissions are being monitored for their effect on air quality. Barring any unfavorable report, the program will be expanded from one to 14 counties next year.

In other energy projects, TVA is revising its rate

A TVA exhibit of alternative energy sources at Land Between the Lakes displays solar panels for new homes.

structure to promote conservation; developing a program to offer conservation loans to business and industry; setting up some experiments using wind power in eastern Tennessee; testing the use of fuel cells powered by gas produced from coal; designing a power plant using fluidized bed combustion (a method of mixing coal with limestone for cleaner burning); and exploring cogeneration (using waste heat from power plants for various industrial processes).

TVA has made its peace with the environmentalists for the most part, but there remains one major bone of contention: the agency's commitment to nuclear power. The board recently decided to delay installation of four of the 14 reactors planned for TVA's six new nuclear plants because of studies showing projected demands had been overestimated. It was emphasized, however, that the reactors will be installed eventually. "I certainly am not in favor of stopping those six plants," Freeman says. "We're not about to turn our backs on investments of billions."

If the environmentalists are generally pleased with the new TVA, the industrial community is not. "Is TVA here to supply energy or here to change social habits?" asks Carter H. Witt, president of the Tennessee Manufacturers Association in Nashville. It is a question that Witt might answer one way, TVA's founders another. It is for the future to judge whether TVA can lead us into the age of energy conservation as effectively as it once led us into the age of energy use. There is some evidence that it can: 121,000 houses surveyed by energy auditors; 52,500 weatherization loans made; 132 million kilowatts shaved from TVA power sales annually. There have been some compromises. An example: in April, Freeman wanted to require that new houses meet energy-efficient standards before they can be hooked up to the power system. By August, he spoke vaguely of setting up a voluntary certification program instead, with stickers to be affixed to qualified houses, like the all-electric Gold Medallions of old.

The better the idea, someone once said, the more inevitable the compromise.

"In any organization the rhetoric tends to come before the action," says Freeman. "We've announced our policies and we're in the process of implementing them. But sometimes you paw the earth a little bit before you finally figure out what will be effective."

Standing by the expanse of window in his office, Freeman looks at the Great Smoky Mountains—a distant tangle of velvet—and considers the problems of retooling an old machine to fit a new reality. "Most agencies do their best work in their early years because they have a fresh mandate for solving a problem that apparently was important enough to create them. As the years go by, they tend to lose their vigor and become captured by their past. I don't think TVA is that old yet; it's only middle-aged. The question is whether a couple of middle-aged men and a younger guy can give it a new burst of enthusiasm.

"We can bring TVA back to its experimental, innovative beginnings, if we can reflect the current realities with the same kind of vigor that TVA had in reflecting the realities of the 1930s and '40s. If not, we ought to turn the power system over to the people of the Valley and fold our tent."

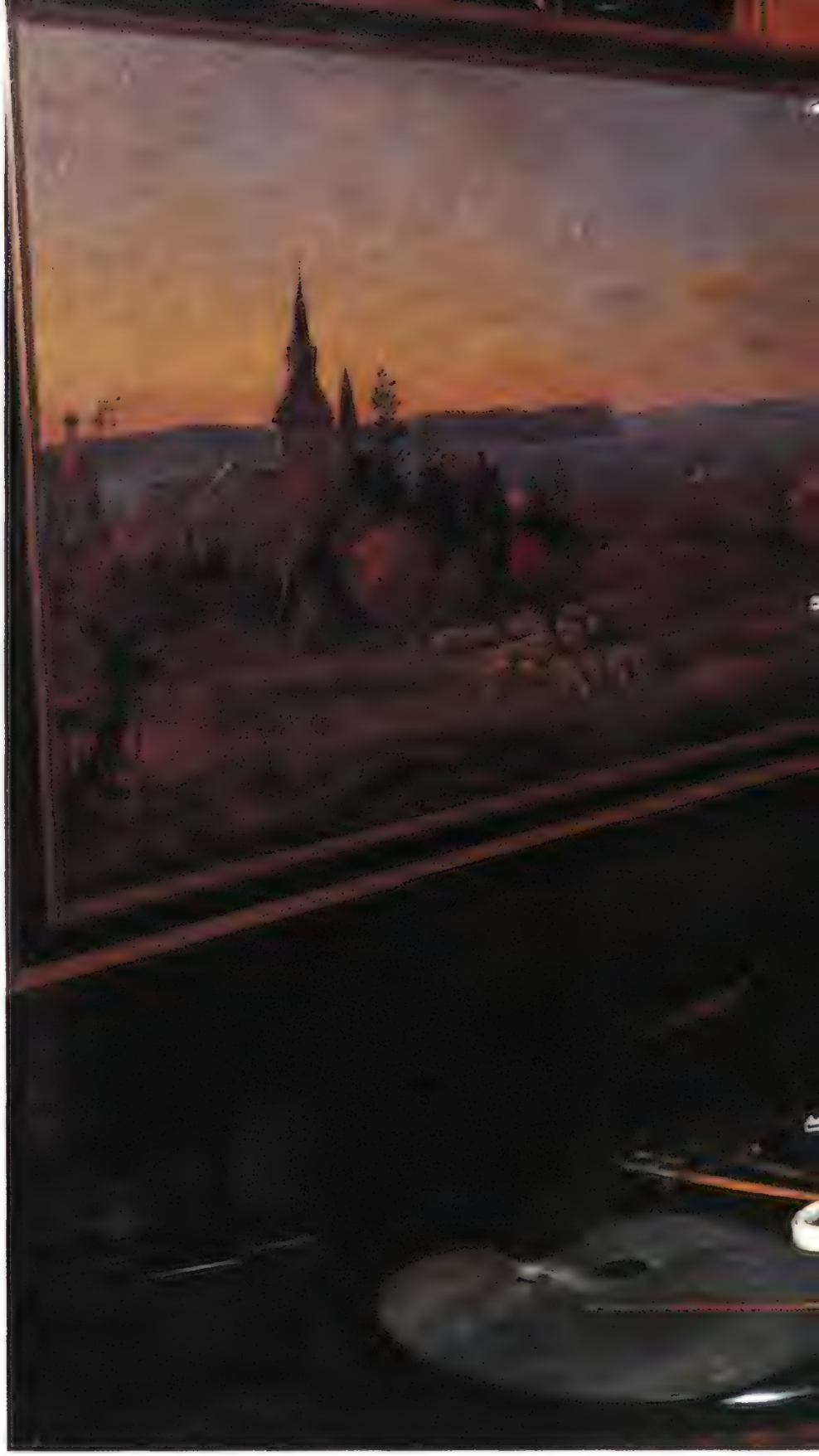
Clifflike piles of coal at Kingston plant feed soaring power needs; TVA burns 35 to 40 million tons a year.

By Julia Markus

Jasper Cropsey's resonant rooms come to life again

Jenny Lind found the painter's 'deep toned' studio very beautiful and most unusual. It is now restored by great-granddaughters

Alert and clear-eyed, Cropsey was 24 when this portrait was painted, in 1847, by Edward L. Mooney.



Cropsey worked in this now carefully restored studio in the house he treasured and embellished. Palette,

That afternoon in June in the mid-19th century when Jenny Lind visited the American landscape painter Jasper F. Cropsey in his studio, we have it in Cropsey's words that "leaning back in her chair she looked around our 'deep toned' room with a perfect satisfaction, saying what beautiful rooms you have Mr. Cropsey." The touring "Swedish nightingale" appreciated that the artist's studio did not "look so white and new" as rooms did all over America.

Today, when the visitor walks into Cropsey's impeccably preserved and restored studio at Hastings-on-Hudson, New York, where he lived from 1885 to his death at the age of 77 in 1900, one is similarly over-

candlestick and mixing cups were his. Painting on the easel is *View of Hudson from Miss Master's School.*

whelmed. The artist designed the square cupola, the exposed rafters, the fireplace, chairs, chaise longue, glass, grillwork and textiles. It is not surprising to learn that the painter was also an architect. He designed churches, at least one apartment building, and the elaborate stations of New York's Metropolitan Elevated Railway, Sixth Avenue Line. Time stops in this studio, and, confronted by the charm of its furnishings setting off the saturated brilliance of the paintings on its walls, one feels again in the presence of Jasper Francis Cropsey.

For many years Cropsey's reputation has been at low tide. He has been banished to the compendiums of American art where he can always be found under C: Cropsey, J. F. (1823-1900), late Hudson River school painter. The neglect was countered earlier in this century by the determined patience and inspired faith of his granddaughter, Isabel Wack Steinschneider, and now by the generosity and efforts of two of his great-granddaughters, Barbara Newington and Beatrice Ellsworth (p.109), who are turning his home and studio into a Cropsey memorial and center for scholarly and artistic study. The story of Cropsey's studio can be taken as a parable of Americans becoming aware of the American heritage of art.

Seventy-nine years have passed since Cropsey's funer-

Photographs by Michael A. Vaccaro

Bedroom windows look out on Hudson River. Artist wore uniform when presented to Queen Victoria.

al cortege became the first to cross the new Warburton Avenue bridge in Hastings. The bridge spanned and marred the view from Cropsey's home down to the Hudson, a view the elderly painter had often rendered in watercolor. It announced, as did Cropsey's death itself, the beginning of the new century.

Cropsey was a child of the 19th century, the eldest of eight born on a farm in Staten Island to parents of Dutch and Huguenot stock. He showed artistic and architectural promise by the age of 13, when with homemade tools he designed and furnished down to the smallest detail a miniature model of a country house. It won him a diploma at the 1837 fair of the Mechanics Institute of the City of New York, and a nickname. He was respectfully known to his neighbors thereafter as "the boy who built the house." Yet until he went to New York City, he had little firsthand knowledge of the plastic arts. "It may seem rather strange that I should be so ignorant of art at that time while with such close access to the City," he would write in an unpublished reminiscence. Once in New York he must have made up for his lack very quickly, for by the time he became an apprentice in an architectural office a few years later he began to paint in secret: "I preferred . . . to go forward as I had always done, by keeping it a secret as far as I could. . . . I would rise at daylight and work till breakfast time, 7 o'clock—and return from the office late in the afternoon and paint till night." Such diligence did not go long unnoticed. When the artist William Sidney

Exterior of Cropsey house today is not noticeably different from time when he lived and worked there.

Julia Markus is a literary historian who specializes in the 19th century. A novelist as well, her book Uncle *won 1978 Houghton Mifflin Literary Award.*

Cropsey's studio fireplace was modeled on one he had admired at Windsor Castle. Inglenooks held two.

Mount saw one of his pictures, "he asked my name, I told him Cropsey. He said I must crop the grass, meaning apply myself to the study of nature."

And so he did. By 1847 his interest in painting was so intense that he took the decisive step for an American artist at that time. Sketchbook in hand and with his bride at his side, he began a two-year study tour of Europe. Cropsey's sketches from nature are evocative and detailed. During the Italian part of his tour he worked in the former studio of his mentor, Thomas Cole, in Rome, but mainly he was out in the environs of Rome and in the Naples area, sketching. From these sketches he would be inspired and reinspired at later times for his larger paintings—the noted religious painting, *Millennium* (p. 111), with its landscape evoked by an imaginative reconstruction of Biblical references and his Italian sketchbooks.

But it was England that most fully gained his heart during that first tour. So much so that Cropsey, his wife, Maria, and their two children returned to London in 1856 to begin a seven-year stay. *Mrs. Cropsey and Daughters in the Stateroom of the Cunard Liner* (p.108) records the artist's family on that sailing. Maria in the background is intent over a book. Reading? Her great-granddaughters assure me she was pressing leaves and flowers from the America they were leaving. For if the Cropseys were Anglophiles in terms of life-style (his presentation costume worn to meet Queen Victoria is today still in good condition, the fireplace in his intimate studio is based on one he saw at Windsor Castle), Cropsey's art and nature interests were American to the core.

In fact, he brought America with him to London, in the form of his sketches. The best of the oil paintings he developed from them, *Autumn—on the Hudson River,* now at the National Gallery in Washington, astonished the usually unflappable British in the London Exhibition of 1862. At first John Ruskin himself couldn't believe that the full brilliance of American autumn was other than an intense fantasy of the American artist. So Cropsey placed a pressed autumn leaf next to it—testimony to the real American autumn he left behind, and testimony as well to Mrs. Cropsey's occupation on the Cunard liner.

He returned to America on July 4, 1863, on the day the Confederates were defeated at Vicksburg, and, as soon as he could, rushed to the battlefields with an artist's ammunition—paint and brush. Eight Civil War miniatures, most immediate and from life, are still at his studio today, but the large *Battle of Gettysburg,* which hung at the New York Union League Club, was destroyed by fire in 1875. It was after this second Euro-

An outstanding architectural draftsman as well as painter, Cropsey designed these stained-glass windows.

Cropsey painted this intimate scene of wife and daughters aboard ship, bound for a stay in England.

pean stay that Cropsey designed the stations, stairways, waiting rooms and platforms of the Sixth Avenue El. The ironwork and decorative motifs of the stations styled in an airy and light Queen Anne manner can also be found in a more intimate scale in the trimmings of the house and studio in Hastings.

Paradoxically, this painter of nature also created a design for a five-story, multifamily house long before apartment houses were to be built in America. If this design, *Apartment House, Front Elevation,* 1867, placed him momentarily among the more progressive architects of his period as Dr. William S. Talbot has suggested, his paintings were no longer being viewed as Jenny Lind once saw them, as "so new and fresh and green."

By the late 1870s there is no doubt that Cropsey's reputation began to decline, as interest in the Hudson River school dwindled. *View of the Hudson from Miss Master's School* of 1889 (p. 104), which hangs in his studio today, may have seemed old hat to the Gay Nineties. This dusky landscape, replete with sheep standing where Broadway now cuts through, could almost be considered a last statement of the Hudson River school. It had to wait for fuller recognition along with so many other paintings in the house in Hastings where he lived and worked for the last 15 years of his life. He didn't know then that his immortality would be preserved by the grandchild who sat by his side.

This child, Isabel Wack, was orphaned when her parents were killed in a train wreck. (There is a family story that she was pulled from the wreck by Jay Gould himself.) Along with her sister, she came to live with her grandparents who had just moved from "Aladdin," the elaborate house Cropsey had built during better days, to the house in Hastings where he built his studio addition. One of Isabel's earliest memories was of her grandfather designing the two inglenooks for his elaborate fireplace. True to his reputation as "the boy who built the house," he designed the entire fireplace down to the andirons. But he measured the facing inglenooks in a special way. He measured them by sitting next to Isabel to determine the width needed for them to sit comfortably side by side.

And side by side they were in spirit. She could not help remembering the decreasing reputation of the

Cropsey's *Hudson River from Villard Hill,* in Hastings, is a typical example of his mature work.

Dining room has Cropsey-designed furniture. On left wall is granddaughter, Isabel Steinschneider.

artist's declining years, the indifference of the public.

She kept Cropsey's memory alive by living herself. It was there in the Cropsey house that she raised her five children. Cropsey's studio was not off limits to the family. She added a piano so the girls could play. If such objects as a particular chair her grandfather designed needed attention, she recovered it with her own needlepoint. She gave parties there. She kept love alive in the room of the inglenooks.

During those gatherings in the 1920s and '30s, people often asked her why she didn't get rid of those "old things," meaning, one suspects, her grandfather's paintings as well as his chairs, tapestries and andirons. She held firm. She believed in him, her daughters recall. She felt, despite the opposing taste of the time, that he would have his day again.

In the late Thirties her husband, William Steinschneider, became mayor of Hastings-on-Hudson, a position he held for 13 years. There was pressure on them to move, because the neighborhood around Cropsey's idyllic home and grounds was a lower-middle-class one. Three- and four-decker houses grew along with the mills. Isabel Wack Steinschneider still

Great-granddaughters, Barbara Newington (seated) and Beatrice Ellsworth, devotedly restored home.

held firm. Instead, there were just more receptions, parties, good times. Her children, Barbara and Beatrice, remember their childhood as an unblemished time. There was no attempt to force them into an appreciation of Cropsey's work or to follow established tradition in caring for it. But it came naturally.

"I was very close to my mother," Barbara Newington told me. Particularly after her mother's death, she simply collected Cropseys. "I wanted to see them." She also felt a spiritual affinity with the great-grandfather she never knew, who was born 100 years before her. In the eerie way the past sometimes has of searching us out, Cropsey's pictures seemed to appear out of nowhere. One couple drove from California to Connecticut with a small gem of a *Paestum* landscape to show her. Others appeared in New York galleries, others at auctions. Some were found by friends. The amazing thing about collecting Cropseys was that they appeared at her front door as unscathed and fresh as a spring day can still be on the Hudson. The private owners of his work had offered him their greatest tribute, they had cared for it and preserved it. Many of Cropsey's paintings and watercolors and architectural designs are still in Barbara Newington's home. She has preserved on her walls the stunning *Autumn* (center), one of two of Cropsey's *The Seasons* locatable up to now. One can see there *Hawking Party in the Time of Queen Elizabeth* (below), and examine how the artist peopled his landscape with figures—an unusual occurrence in his work.

Through the Fifties it was relatively easy to find paintings by Cropsey. They commanded a certain price, but they were still not in fashion. Many of the collected paintings were by then old enough to be considered rather charming, but, my dear, they were, after all, only by an American. No one would advise getting rid of such "old things" anymore, but the collection was still a family affair. A candle lit, if you wish, to Isabel's memory.

Then one night in the early Sixties, the sisters were home watching TV. As Jacqueline Kennedy passed from room to room of the White House she had just refurbished, she stopped in front of a painting, *Mountain Glimpse,* and said that it was a work by that notable American landscape painter, Jasper F. Cropsey. "We were amazed," Beatrice Ellsworth told me. It was a novel way for another of Cropsey's paintings to enter his great-granddaughter's living room, while entering millions of others, via the tube.

Cropsey painted this anecdotal picture, *Hawking Party in the Time of Queen Elizabeth,* in 1853. Untypical of his work, the scene could illustrate any number of situations in a historical novel by Sir Walter Scott.

Of Cropsey's series, circular in form, *The Seasons,* only two

Beatrice Ellsworth believes the slow reawakening of interest in Cropsey began the night Jacqueline Kennedy told the nation that American art was part of its heritage. She also feels that the current interest in ecology has made a younger generation interested in how nature looked when Cropsey was painting here—in the days before Washington's headquarters burned down. Today a condominium stands on the site.

When in 1970 William Steinschneider died and the Cropsey home and studio became empty for the first time since 1885, the sisters knew they wanted to preserve it, and not only for family sentiment. A widening critical and scholarly interest in his work had begun. By 1978 the Cropsey home had been placed on the National Register of Historic Places, and the sisters had established the Newington-Cropsey Foundation for its maintenance.

The final phenomenon of Cropsey's reemergence is that now, when after more than a century of polite disinterest scholars and art lovers want once more to examine his work, it is not scattered in dark corners all through the country. Because of Isabel's determination and her daughters' generosity and efforts, the core of his work, his sketches, his oils, his watercolors and his architectural drawings, will be housed and reevaluated in their natural setting.

One of the works his great-granddaughter retrieved is an architectural drawing, *Italian Composition,* executed in the early 1840s before the artist had been to Italy. In an unpublished reminiscence he called it with becoming immodesty "the best and most perfect specimen of my early art, in which originality and entire self-dependence was exhibited . . . produced in the latter part of the 20th year of my age." So superior was it to the work of his peers that the National Academy of Design chose to exhibit it away from them, hanging it instead next to the work of Cole and Durand.

By early 1980, Cropsey's house and studio, in basically good repair already, will be opened by appointment. This is an intimate place that could never respond to the demands of busloads of tourists. It is the interested individual, the art lover, the student, the artist, who'll find his way here. Then in the years to come there may be an annex and archives established, and more Cropseys hung near their fellows. It is certain to become a small, valuable center of research, which will make a substantial contribution to American culture.

That day Isabel Wack envisioned draws closer.

are known today, *Autumn,* 1855, above, and *Spring,* also 1855.

A visit to Italy inspired different subject matter and landscapes in the artist's work, as depicted in *Millennium.* A much-admired religious painting of the time, it has an imagined Biblical setting.

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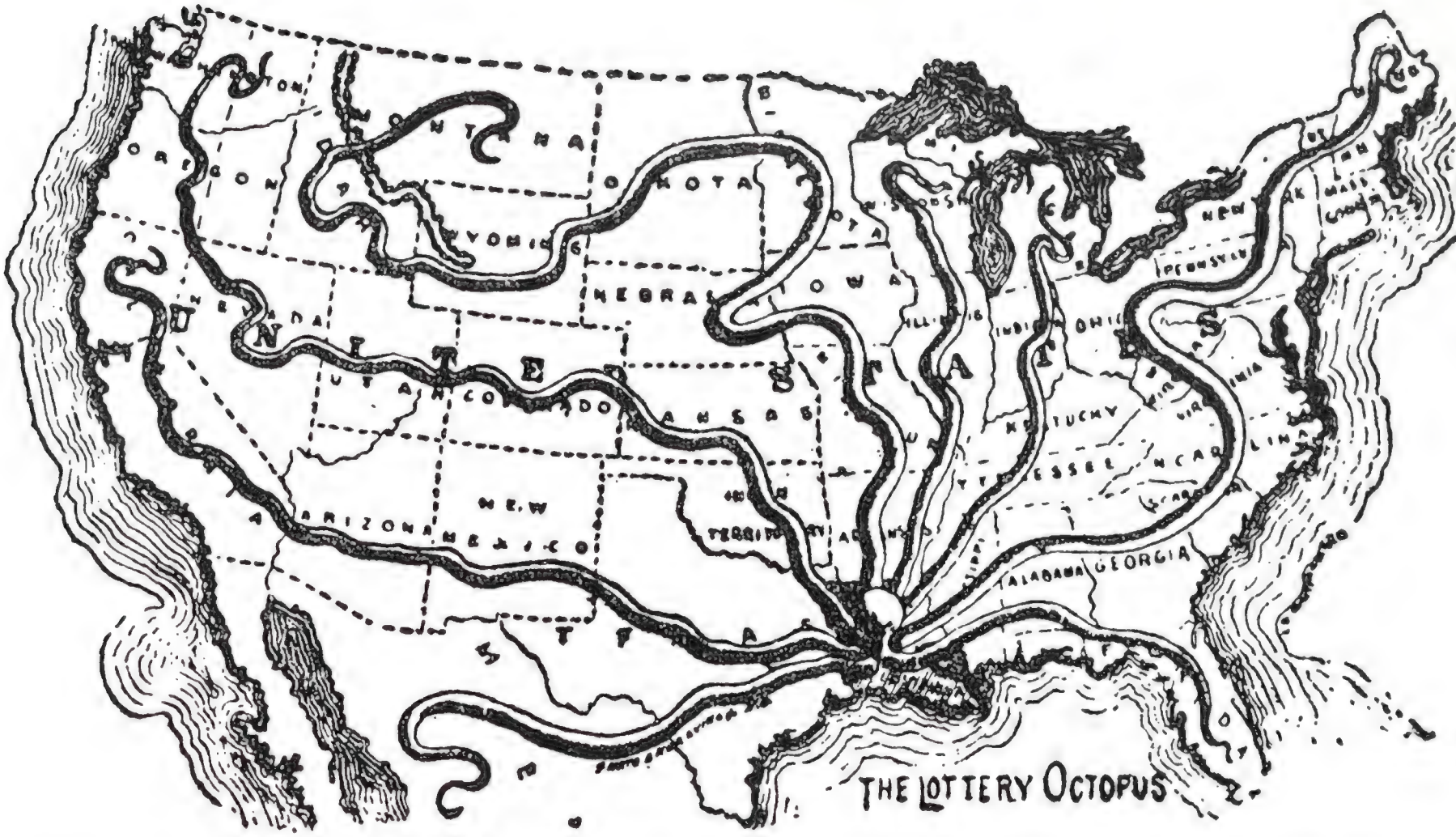

Tentacles of the $500-million-a-year "Octopus" of Louisiana, as opponents called the lottery, spread all across the nation. This 1890 cartoon is in error: the Dakota Territory became two states in 1889, preceding Washington.

By Peggy Robbins

Louisiana lottery was so big it didn't *have* to be rigged

The carpetbaggers got it legalized by well-greased legislators; after 25 years Supreme Court killed the monster

The author is a Memphis free-lancer who writes on historical subjects.

The carpetbagger legislators of Louisiana in 1868 were a sorry lot, graft-hungry and irresponsible. One historian wrote that their sessions were the scene of "dice games, drunken vomiting, and pitching shoes at the crystal chandeliers." In August the lawmakers, generously bribed, maintained order long enough to legalize the incorporation of the Louisiana State Lottery Company, paving the way for the greatest lottery ever to exist in this country, one that was to drain as much as $500 million annually from the American people. Damned as the "Golden Octopus" by its critics, the lottery's influence touched almost every facet of life in Louisiana—and far beyond.

Lotteries—drawings from many tickets purchased at little cost to select a few winners—had been used in New Orleans since early in the 19th century to raise funds for public, educational and charitable purposes, from the founding of a university to the construction of churches and a Masonic Hall. But those relatively small lotteries were not set in motion by crooked lawmakers, and the profits derived from them went for the stated needs. They were parent to the "octopus" born in 1868 only to the extent that they nurtured New Orleanians' hardy appetite for taking chances, and made the city a promising area for young men with a huge-scale lottery scheme which would, its promoters argued, "partially replenish finances dissipated by the War between the States."

Best known of the entrepreneurs were Johnny Morris and his friend Charley Howard, well-met, ingratiating fellows from New York. They arrived in New Orleans in 1868 and obtained from the state government a 25-year lottery charter. Accounts of how much they paid "under the table" in cash to influential legislators vary from "$50,000 in gold coin" upward. They also paid the grafters in Louisiana Lottery Company stock, which was later worth huge fortunes.

The company's purposes, as set forth in its tax-exemption application, were "charitable and educational." It was pointed out that many foreign states and cities conducted lotteries to raise revenue. Overlooked was the fact that those operations usually were required to pay out in winnings three-quarters or more of each take, whereas the Louisiana law allowed

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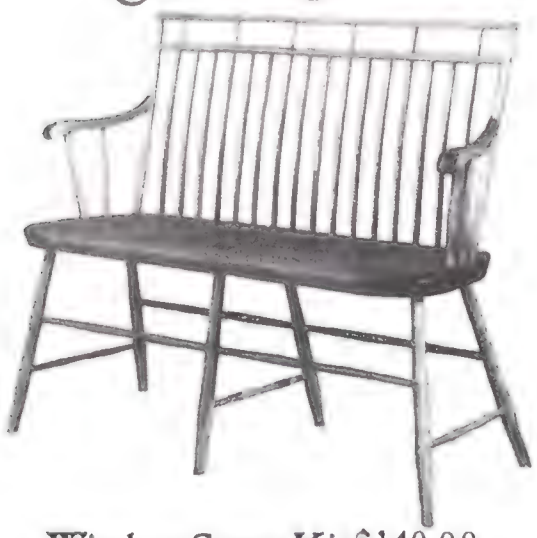

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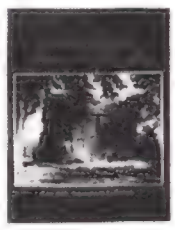

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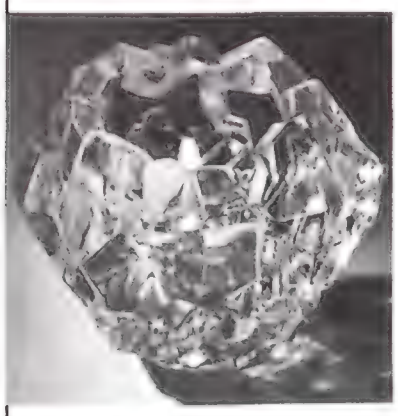

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John Morris, a clever New Yorker, concocted the lottery scheme.

the Lottery Company to retain half. The company pledged donations to asylums, charity hospitals, the French opera and yellow fever funds. A pledge of $40,000 a year to the Charity Hospital of New Orleans was incorporated in the legislative act which granted the firm a lottery monopoly and freedom from taxes.

The company met with phenomenal success early on, with a first year's take of more than a million dollars. Before long its estimated annual gross income was from $30 million to $60 million, of which only $40,000 went to the State of Louisiana. Tickets of different sorts were sold, some for daily drawings in New Orleans, some for monthly drawings for the entire country, still others for a semiannual drawing for the world at large. The capital prize in the last was $600,000 on a $40 winning ticket.

All over New Orleans there were "policy shops"—some just in the corners of groceries and pharmacies—operated by the Lottery Company in which printed tickets could be bought for 25 cents to $500, the difference depending on the lottery to be entered and on whether the purchaser bought a fractional or whole interest in a number. In October 1891 there were 108 such shops in the city, each with average receipts of $60 a day—a daily gross of about $6,480. At each daily drawing—one was held at four o'clock every

Charles Howard, Morris' partner, also waxed rich on the take.

afternoon, at first in various theaters and public halls, later in the "Lottery Home" constructed specifically for the company's business—prizes totaling $2,500 to $3,000 were awarded.

New Orleans went lottery mad. The passion to "play lottery" led to small thefts by servants and clerks, and big embezzlements by businessmen; bank depositors withdrew their savings to join the gamble; housewives boasted that they bought a ticket every single day; people chose numbers according to voodoo charts, dream predictions, their children's ages, the fish count in a catch, and the Pope's birthday; and priests were kept so busy blessing tickets brought to them by Catholics that the archbishop was compelled to forbid such practice.

An enormous amount of strange superstitions relating to the selection of lottery numbers built up: the sight of a naked leg, as long as it did not belong to one's wife or mistress, was a sign to play 11 or some multiple of it; a view of a gray-haired female corpse meant play 49, some said, others 59; a drunken man suggested 14 and a stray dog 6.

The drawings were held on a stage bearing two hollow glass wheels, the larger holding all the lottery ticket numbers, the smaller holding capsules, each carrying a slip of paper stating the prize to be paid. Crowds were present at every

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An 1889 newspaper sketch shows vendor of lottery tickets doing a brisk business with avid buyers on the street, in New Orleans' bustling French Quarter.

drawing, but it was not necessary to be present to win.

Within a year of being established in New Orleans, the company had a branch in every sizable city in the United States, and there was hardly a village that did not have a subbranch or agent. In some cities the agent had to work undercover. In Chicago, the "secret" headquarters operated across the street from the office of the inspector of police. A local policeman won a $15,000 prize and opened a saloon which he named "The Louisiana." The business failed because the policeman put his profits back into the lottery.

Charley Howard had supplied the "gold grease for the legislation" to get the scheme rolling, and it was Howard who managed the expansion of the lottery to a worldwide operation. The company was concerned that the drawings be considered irreproachably honest; they *were* honest, "on the square" and completely legal—there was no reason for them to be otherwise—but occasional rumors hinted that they were "fixed." The owners hit upon the brilliant idea of hiring two distinguished old former Confederate generals and heroes, Pierre Gustave Toutant Beauregard and Jubal Anderson Early, to preside over and cast an aura of respectability about the proceedings.

Both men were in financial straits, but they hesitated to become associated with the lottery. Assured that they were expected only to appear on the stage for a few minutes to certify the fairness of the drawings, for which each would receive munificent reward—variously estimated at from $10,000 to $30,000 annually—they agreed. After that, with nuns escorting two boys from an orphanage to the proceedings, and the two old soldiers—Beauregard with snow-white hair and moustache and Early badly stooped—blindfolding the boys, opening the trap doors of the wheels, and reading out the numbers and prizes, the whole ceremony was impressively wholesome.

But the two main figures of the lottery operation, who were now called Mr. John A. Morris and Mr. Charles T. Howard, had problems in the form of greedy politicians. The very legislators who had legalized the lottery *could* seek to outlaw it—and so they weren't inclined to stay bought. The lottery had maintained a payoff fund since its early days, but that was never sufficient.

Morris and Howard worked together closely as the main pillars of the lottery, but presented different fronts to New Orleans society. Morris, who had the refined air of a gentleman accustomed to leisure, was elected to some of the best clubs. Howard, a large, commanding man, described as "just right for a handsome gambler," came to be known as "Lord of the Lottery." When the Metairie Racing Club ignored his candidacy for membership, he served notice that he would turn their racecourse into a cemetery, and he did just that. He was killed in 1886 when he was thrown from a horse

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near his summer home at Dobbs Ferry, New York. His heirs spent huge sums on philanthropic projects in New Orleans dedicated to his memory—which one early historian classed as "the single unselfish benefit that Lottery money has conferred upon New Orleans."

According to one account, John A. Morris by this period was "a multi-millionaire, master of Morris Park in New York, owner of the Westchester Racetrack, breeder of thoroughbred horses and owner of stables, as well as a dozen homes in America and Europe." He knew, wrote an antilottery man in 1890, "how to command the support of every purchasable man in Louisiana."

The period between 1875 and 1890 was the time of the lottery's greatest prosperity, but it was also the period during which opposition to the lottery developed on moral grounds. Carpetbagger rule ended in Louisiana after the withdrawal of Federal forces in 1877, and the legislature of 1879 managed, after a "close and desperate contest," to rescind the company's charter. It hardly mattered—the company succeeded in having its charter incorporated into the new Louisiana State Constitution written a few months later, before the repealing statute became effective. The lottery was safe until the expiration date of its original charter on December 30, 1893; as to the clause in the new law of the state provid-

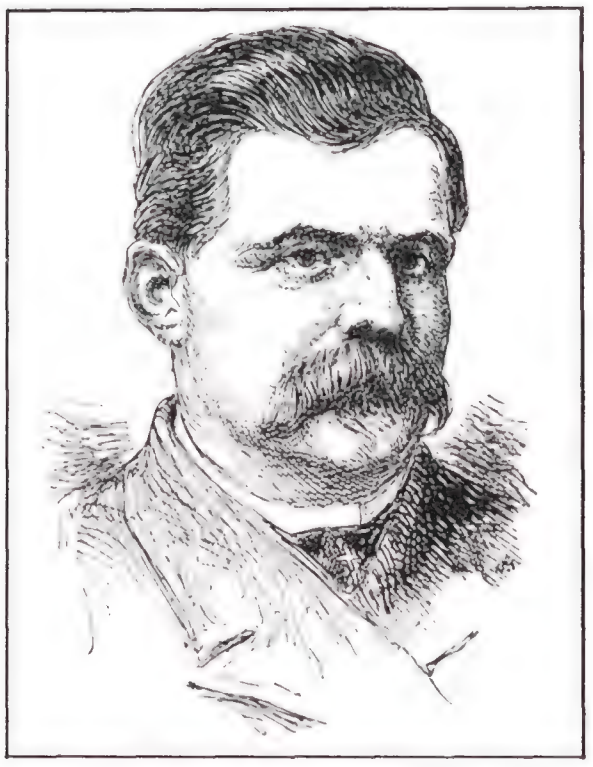
An early lottery opponent was A. K. McClure, Philadelphia editor.

ing that *all* lotteries would be prohibited after January 1, 1895—well, lottery interests would get to work in time on that.

The first noteworthy opposition to the lottery outside Louisiana occurred in 1883 when A. K. McClure, editor of the Philadelphia *Times,* led a campaign which persuaded the Pennsylvania legislature to make the advertising of lotteries illegal in the state.

In 1890 opposition in Louisiana itself got organized under State Senator Murphy J. Foster. First he tried to get the legislature to investigate charges of bribery and corruption against the lottery. When that failed, he joined with the new Anti-Lottery League of Louisiana, formed by a group of seven civic leaders determined to fight the combine. The League's first difficulty was in getting members, because citizens were terrified of the power of the company.

Perhaps the most passionate member of the League was the Reverend Beverly Carradine, a Methodist minister in New Orleans. "Did you ever study the building of the Lottery as it stands on the corner of St. Charles and Union Streets?" he asked dramatically. "Look carefully and you will discover that its foundations rest on human misery; its walls, like hands of agony, look up and clutch at a receding sky. . . . And its clerks are kept busy writing down, day and night, how many fools there are in the United States."



John C. Wickliffe was among founders of Anti-Lottery League.

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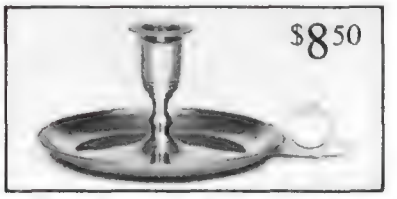

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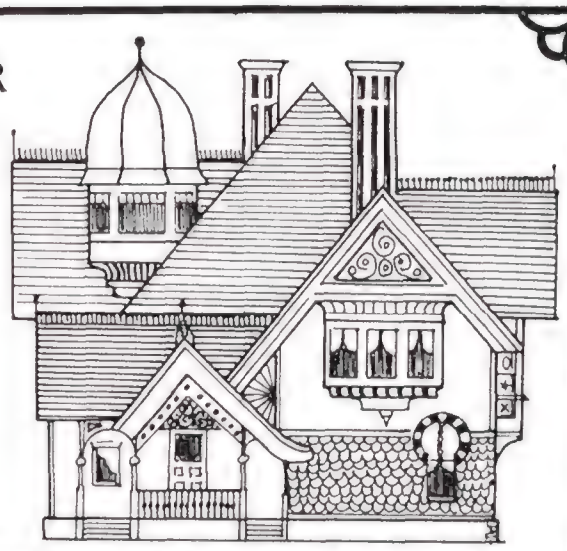

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Since the lottery controlled most of the local newspapers, the Anti-Lottery League established its own paper, *The New Delta,* to fight the lottery. The first issue came out on May 12, 1890, the day the legislature assembled. "When that body met," wrote John C. Wickliffe, one of the founders of the Anti-Lottery League, "nearly two-thirds of each house were opposed to the proposition of Morris." Whether or not because of the attack on him by the paper, the next day Morris raised his offer from $500,000 to $1,250,000 a year for the lottery privilege. He then went to work on the Louisiana legislature.

Indeed, wrote Frank McGloin, who was another League founder, "the future historian, when he studies the minutes of the two Houses of the Louisiana Legislature during its last session, will wonder . . . whether its members had taken an oath in behalf of the State and people for a faithful discharge of duty; [or] whether, in fact, the oaths taken were not in behalf of John A. Morris and his associates."

However, McGloin reflected, considering such company moves as its $150,000 gift to repair levees to protect people from the flooded Mississippi—this as the legislature assembled—it was not too surprising that graft-tempted legislators succumbed to the lottery lobby.

The legislation for rechartering the Lottery was presented under the sugar-coated title "Revenue Amendment"; it listed how the Lottery's $1,250,000 annual payment (in lieu of taxes) was to be apportioned among various state needs.

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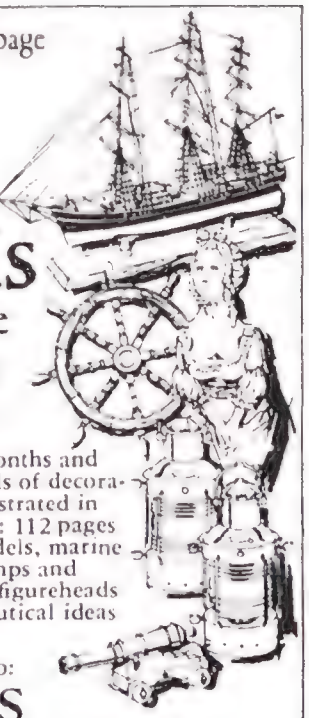

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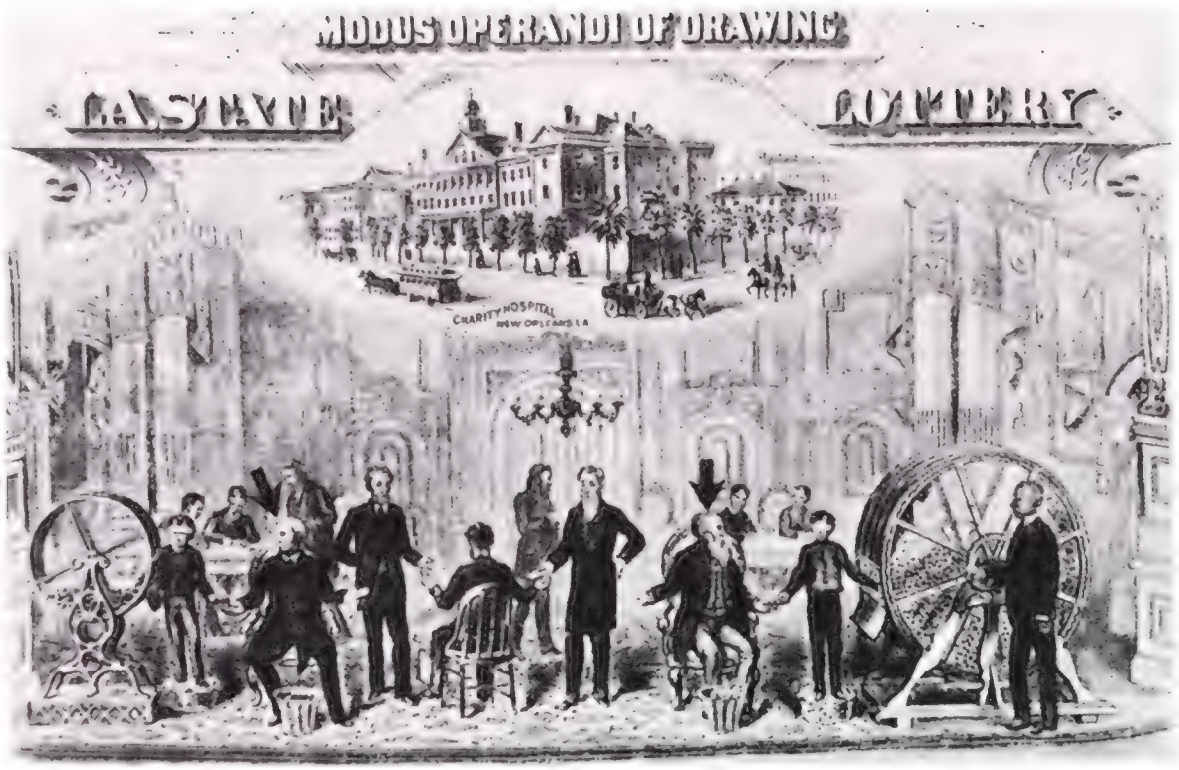

Former Confederate Generals Pierre Beauregard (left arrow) and Jubal Early (right arrow) presided over the lottery drawings, helping to induce a belief by the public in the honesty of the proceedings.

Strange events accompanied the vote on the bill—so strange, reported *The New Delta,* that "several times did it seem as if the hand of God was interposed to stop it." Once, when the bill was about to be voted on in the House and the pro-Lottery forces had the exact number of supporters to win, "one of them, a 'convert' from the Anti-Lottery side, was seized with a sudden illness, which threatened his life and compelled his instant withdrawal from the Chamber. His seizure was sudden and without warning. . . ." Thereupon the vote in the lower chamber was postponed.

Further efforts were made by lottery forces "and the required 66 votes again mustered; one more man had been won over. [But] a member who had that morning for the first time announced his intention of voting for the bill, suddenly fell, stricken with something akin to paralysis, and was borne out. . . ."

When the bill came up the third time in the House, the lottery forces delivered the necessary two-thirds vote. "The bill's passage," reported *The New Delta,* "was effected during the most violent storm which ever raged in Baton Rouge. The rain poured in torrents, the winds lashed the walls of the State House in fury, the thunder rolled in deep toned disapprobation of the outrage which was being perpetrated, the lightning played almost constantly around the building and just as the Representative who had it in charge cast his vote the capitol was struck by lightning."

In the Senate Murphy Foster and a few others pleaded and struggled desperately to turn the tide against the lottery. *The New Delta* lashed out against the "Golden Lottery Octopus" and the company's "systematic debauching of a whole people." Startling drawings of the Octopus spread over a map of the United States, its arms stretching into every area of the nation—"Slimy, writhing arms, sucking the golden life-blood of the country"—appeared first in Louisiana papers and then in publications around the nation (p. 113).

It was a losing battle. The senate passed the bill on July 1, 1890, and it was sent to Governor Francis Nicholls. He returned it on July 7 with his veto and the declaration: "I will never permit one of my hands to assist in destroying what the other was sacrificed in endeavoring to uphold—the honor of my native State." (Ex-Confederate officer Nicholls had lost his left arm in the battle of Chancellorsville.) That, too, was a losing effort. The House passed the bill the next day over the governor's veto. The senate would have followed suit had not a member—a lottery man whose vote was needed—returned ill from a trip to New Orleans,

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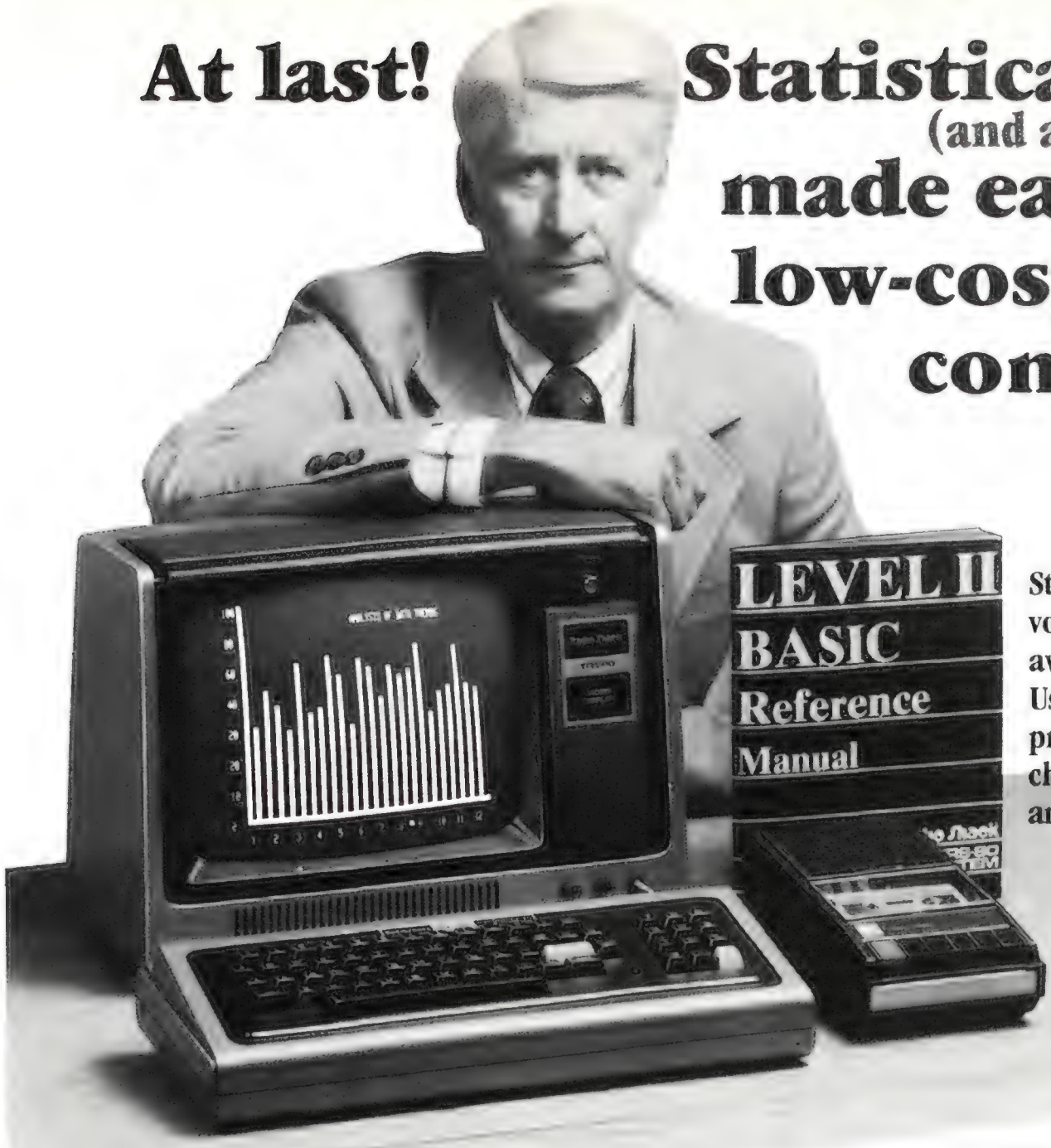

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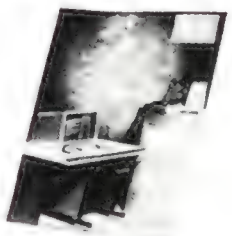

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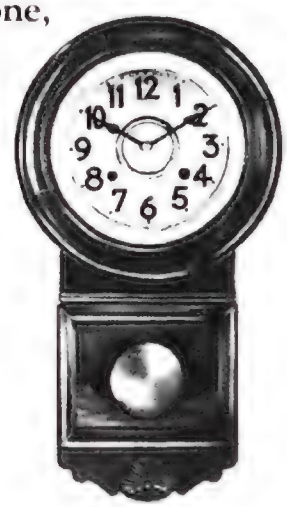

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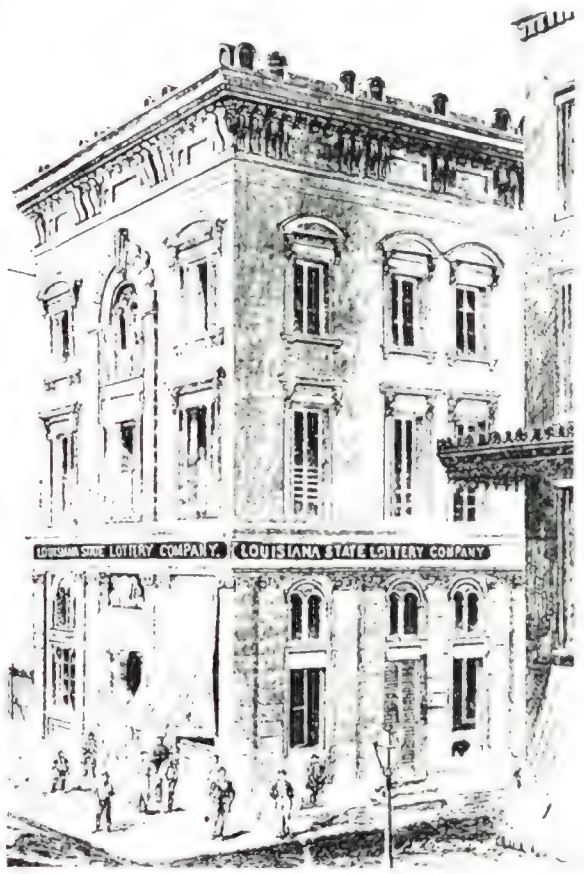
where, "on the wings of victory, he had acquired a state of delirium tremens." He died, whereupon the pro-lottery senators decided that, since the bill had already been passed once, it wasn't necessary to vote any further on it or to have the governor's endorsement.

The Supreme Court of Louisiana set aside all objections to the passage of the bill. The pro-lottery legislation became a law. Some months later, the senator who had been the last antilottery man to be converted to the lottery side died in the Hotel Dieu in New Orleans. It was related that, after he had cast his vote for the Revenue Bill, he "sank into his chair, and in shame buried his face in his hands." On his body was found a money belt containing $18,000, thought to be part of a larger sum paid for his vote.

The Anti-Lottery League continued its fight, and in 1892 Murphy Foster was elected governor on an antilottery platform. But the grasp of the Golden Octopus was too powerful to be torn loose by Louisianans alone.

Help came from outside. C. C. Buel, an editor of the influential *Century Magazine*, went to New Orleans to investigate. The story he told in the February



Home of the lottery was a staid New Orleans building, above; it was caricatured, right, as a hotbed of fraud and misery.

1892 *Century* exposed "the pestilent gambling enterprise" and stressed that the lottery required national remedies.

Newspapers throughout the country began publishing pleas by Anti-Lottery League members that the sale of lottery tickets be prohibited by law in the respective states, and some states complied. Women's organizations in various states took up the League's fight.

In September 1890 the United States Congress had passed, and President Benjamin Harrison had signed, a law making it a criminal offense to use the federal postal system for sending lottery material. Two years later, over objections from the Louisiana Lottery Company, the Supreme Court of the United States decided the law was constitutional. Federal enforcement of it doomed the Golden Octopus. The colossal gambling adventure was reduced to a small local business that wanted no obligation to contribute $1,250,000 annually to Louisiana; it withdrew its request for a new charter.

Some of the lottery men moved to Honduras and set up new gambling operations, but most just retired with their fortunes and contented themselves with a life of rich respectability.

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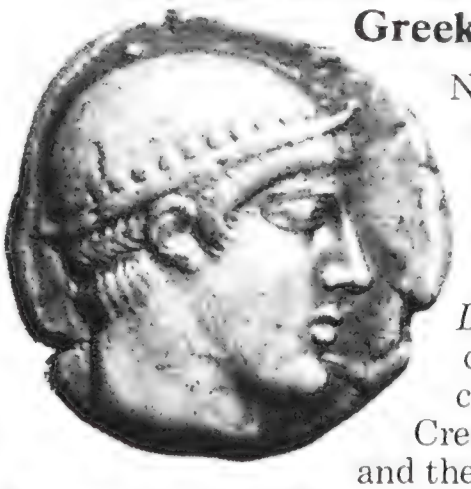

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Book reviews

The Life and Work of Winslow Homer
Gordon Hendricks
(Abrams, $45)

Winslow Homer's Magazine Engravings
Philip C. Beam
(Harper & Row, $20)

Great art and artists provoke as well as sustain continued reexamination over succeeding generations. In America, Winslow Homer has appropriately been the focus of broad study virtually since his death at the beginning of the 20th century. Currently, an ambitious investigation of the artist's major paintings is known to be under way by one scholar, and Homer's foremost biographer, Lloyd Goodrich, is at work updating for republication his definitive catalogue raisonné. What, then, are the relative contributions of these latest publications?

Hendricks' book follows the approach of his previous monographs of Thomas Eakins and Albert Bierstadt in undertaking what is principally a biography, illustrated with handsome reproductions of the artist's work. There are numerous new details of Homer's life added here, some interesting, many trivial. Often the tone is unnecessarily contentious, as when the author takes small shots, one by one, at other Homer authorities.

As we have come to expect from Abrams, this volume is filled with many attractive color plates and extensive black-and-white reproductions, several of drawings and watercolors not previously illustrated in the Homer literature. In addition, there are checklists of Homer's works in public collections in the United States and of his published graphics, as well as a comprehensive bibliography (although all of these have already been undertaken, respectively, by Goodrich, Barbara Gelman, Philip Beam and Melinda Dempster Davis).

While the reader will find Homer's achievements attractively packaged here, he will look in vain for much insight into the works of art themselves. For example, about one of Homer's greatest paintings, the culminating *Right and Left* of 1909, Hendricks writes that it is one of his best, a "really distinguished" oil; but beyond that we are told no more than that

Homer's *Army of the Potomac—A Sharpshooter on Picket Duty.*

Courtesy National Gallery of Art

A late, major work of Homer's, *Right and Left,* dated 1909.

it was finished in January of that year and promptly sold.

Yet it is precisely the probing and thorough analysis of such individual masterpieces that is now really called for. Nicolai Cikovsky jr. has recently published (in the Metropolitan Museum *Journal*) just such a study of the early *Prisoners from the Front,* and Philip Beam's new book on Homer's print illustrations surveys another neglected section of the artist's oeuvre. Describing his graphic output as a separate early career, Beam shows how Homer preeminently fulfilled the storytelling needs of Victorian America, even as his graphic training prepared him for the independent strengths of his later career as a painter in oil and watercolor. Although Homer's deeply ingrained love of the out-of-doors

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stamped his art with a specially American character, Beam discusses the interesting possible influence of 18th-century English caricature on his imagery, citing the artist's lifelong subscription to the *Illustrated London News*.

Nearly 100 engravings, or about half of Homer's total, appeared just between 1867 and 1875, in a wide variety of publications. Beam lists 11 magazines carrying these prints, with *Harper's Weekly* holding the longest association with Homer. Many illustrations embodied the sentiments of contemporary novels, and we might only have wished for further analysis of the literary context of these images, the poems and essays which these accompanied. The author explains the various technical changes in wood engraving through this period, and comments on the 20 known engravers of Homer wood blocks.

Beam has organized his book into a few short chapters devoted variously to Homer's themes, formal aspects, techniques, stylistic developments, and professional and economic circumstances. Following these, all the engravings are illustrated in groups year by year, giving one a vivid sense of Homer's actual artistic evolution. In lively and readable prose Beam articulately integrates documentary information with general esthetic concerns. The clean layout of this book matches the vitality of the subject.

—John Wilmerding
Curator of American Art
and Senior Curator
National Gallery of Art, Washington

Art of the October Revolution
Compiled and introduced by
Mikhail Guerman
(Harry N. Abrams, $25)

Revolutions turn outsiders into insiders. During the decade before the revolution of 1917, a band of young Russian artists overturned academic traditions and took up the most uninhibited modernism with a vengeance. Starting as imitators of Cézanne and Picasso, they soon equaled and even surpassed their mentors, at least in sheer boldness and verve. Among these Russians were such luminaries as Vasily Kandinsky, Kasimir Malevich and Marc Chagall—all justly renowned today. But until 1917 they were all outsiders to the Russian establishment in the arts. Only with the overthrow of the Romanovs could they hope to gain official recognition, to become insiders.

The 384 plates in the handsome book (printed in Finland) tell the story of how the avant-garde outsiders of prerevolutionary Russian art tried to leave their visual stamp on the regime created by Lenin, Trotsky and the Bolshevik party. That they ultimately failed is widely known. On the other hand, what is still not fully appreciated, either in the West or in the Soviet Union itself, is how far-ranging was their effort and how nearly they succeeded in gaining official acceptance, at least until the mid-1920s. This book helps tell that story.

Mr. Guerman, a Soviet art historian, was permitted to cull the holdings of the principal Soviet museums and present his selection to readers. He has brought to light scores of important paintings and designs that heretofore were known only to those rare persons allowed into the reserve collections of the Tretyakov in Moscow or the Russian Museum in Leningrad. To be sure, experts will recognize some works that have been published elsewhere. But for sheer comprehensiveness, this collection of paintings, posters, prints and placards has no rival.

Some of the most intriguing works are by artists whose very names are virtually forgotten. Kliment Redko's *Factory* of 1922, for example, reveals an artist of great talent reveling in the new esthetic of industrial civilization. Others are the work of artists whose prerevolutionary innovations have been fully appreciated but whose postrevolutionary experiments have attracted less attention. Malevich's *The Red Cavalry* of 1918 is one such work, a minutely rendered cavalry charge in red, racing above rich strata of colors.

So intriguing is this multimedia collection that the reader inevitably begins posing his own questions about the text. What exactly were the artists' politics? How did the political revolutionaries view the boisterous painters? What did the peasants and workers think of the wild abstractions? And why did the movement eventually die?

Unfortunately, the text answers none of these questions. Worse, it treats them as pretexts for political homilies that are as distorted as they are tedious. The Bolshevik (October) revolution is several times confused with the revolt that toppled the czars earlier in 1917; artists whose politics were decidedly anarchistic

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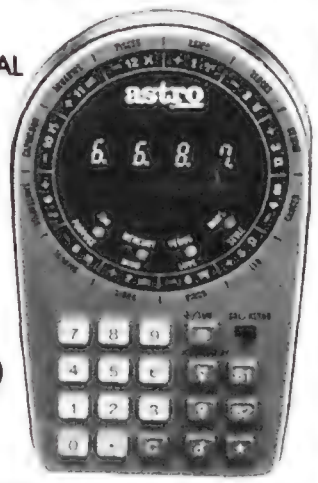

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are presented as enthusiastically pro-Bolshevik; and Lenin's own dislike for the "Futurist" painters is not so much as mentioned. Still worse, we are told that the reason the artistic explosion petered out is that by 1922 the "invalidity of the avant-garde position had . . . been clearly revealed," and the artists fled back to realism without the slightest prodding from the government.

It is not surprising that this handsome volume should reflect the continuing ambiguity of Soviet official attitudes toward Russia's long-suppressed avant-garde. What is surprising, and most welcome to Western readers, is that the Soviet government chose to part the curtain of official disfavor as far as it did.

—*S. Frederick Starr*
Secretary, Kennan Institute for Advanced Russian Studies, the Wilson Center

The View in Winter: Reflections on Old Age
Ronald Blythe
(Harcourt Brace Jovanovich, $12.95)

Although the aged are the great travelers of the world, they mostly wander outside the realms of geography. Instead, their common destination has a much more golden aura to it. They are time trippers, headed for The Past, where the smallest scraps of memory will serve for both flare and passport.

True, the aged tend to forget their hats and coats now and then, but they are uncannily accurate in recalling the heft and smell of the fishing line they may have worked on the river one day 75 years ago. Here, for example, is how an 82-year-old blacksmith-farrier recalls his introduction to the trade: ". . . my father he taught me like this. He heared of a lovely Suffolk hoss that had bruk a leg in a field over there and that had to be destroyed. 'See if you can git the two front legs,' said Father. 'From the knees, mind.' I saw the man and he cut 'em off for me. My father, he told me what he wanted me to do. 'I want you to saw right through, hoof an' all, so as you can see inside the proper structure o' the leg.' Then he riggd up an ol' copper across the road, on that very spot, and he boiled the other leg until all the bones were free. That's how Father larnt me all he knew."

The recording angel of this and countless other delightful anecdotes in this book is the wizard of oral history, Ronald

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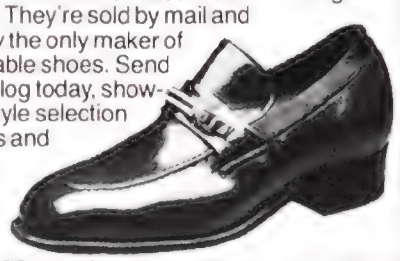

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Blythe, whose previous book, *Akenfield: Portrait of an English Village,* has now become a classic. There, Blythe explored the diurnal comings and goings of country folk. Here, Blythe investigates a special subset of village life, the aged. These are the people who, in the words of Charles Lamb, simply appear to "walk about; not to and from."

True, there is loneliness, poverty and sickness. And an overwhelming sense of slowing-down physical ability. But there are compensations. Bodies that were soft at 60 seem to harden again at 80. And best of all, there can be a wonderful companionship between grandparents and grandchildren.

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Blythe's research amply shows that one's great deeds seldom count for much at the end of a long life. What counts are the still-fresh memories of the day one learned to catch eels with a ball of worms, of cousin Bert coming down the lane from seaman duty in the tropics with a pet monkey over his shoulder, of hiding in the mud at Passchendaele or Ypres. The impulse is to piece together a real self from all these scraps—to figuratively check out the tree barks you carved your name on when you were very young. It's OK to be autobiographical, even when you can't find your eyeglasses. Memories such as this, from an 83-year-old soldier, are truly a monument to the form: "How I liked India! It was marvellous to be an Englishman there. Why, you were more somebody there than you were in Suffolk. True. Of course, I took good care of myself—though many didn't! They'd get out there and they'd not wear the helmet, or they'd go out and encourage a snake, and all such tricks as that. But, oh, the loveliness of Calicut and the palm-trees down there, the all sorts of spices . . . and the ginger factories. How can I describe it all! . . . It's a long time away now, but I can't stop thinking about India. Not now."

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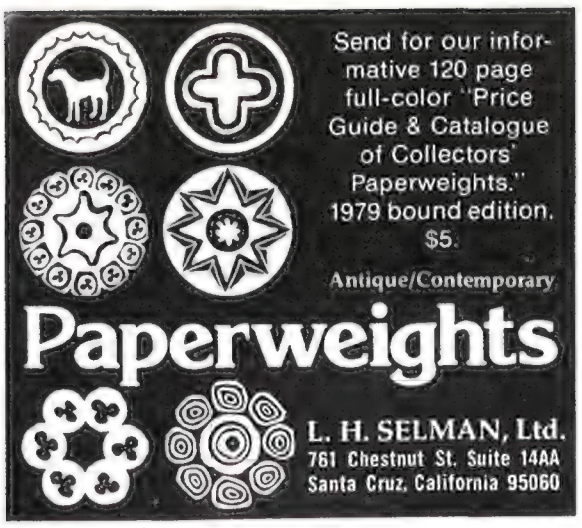
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teachers by the hearth has been bypassed by the mobility of modern society. The youngsters to whom they should be passing on their lore and love are too far away, in another town, another country. That is a pity, because that combination of lore and love may be the most valuable gift of the aged. A 79-year-old cleric put it like this: "The lesson to be learnt is to understand the promotion from plum-easy doing to the surprisingly difficult non-activity of just *being*. Be patient, be gentle, be *nothing*. Somebody said that the real vocation of old age was to give out love . . . I told an old lady in a home this and she said, 'What a lot of rot!' But within a fortnight she'd begun to get the hang of it, and it made all the difference to her."

—*Michael Olmert*
Critic and writer

Cities of the American West: A History of Frontier Urban Planning
John W. Reps
(Princeton University Press, $75)

Most cities of the American West did not develop out of a process of gradual incremental growth sown by an established agrarian population. They were deliberately planned, surveyed, constructed and often marketed by individuals or groups of speculators, churches, railroads, corporations or government agencies. Those towns which did grow to become cities had a sustaining reason for being: they sat on a transportation route or at a terminus, at the center of a promising agricultural region, at a source of waterpower or of rich placer deposits. In 1849 a visitor to the site of one that soon failed, the City of New York of the Pacific, observed: "There never will be a large town there, for the simple reason that there is no possible cause why there *should* be one."

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of the Great Basin Kingdom, the development of the Pacific Northwest, the Central Plains, the railroad towns, and Oklahoma's overnight cities resulting from the land rush.

The content is presented in a variety of forms, each of which contributes to a complete view and analysis of the towns and cities. Each medium—the author's factual descriptions, anecdotes, maps and 500 illustrations—weaves throughout the book threads that are equally interesting in themselves.

Despite the immense variety in geography, climate, cultural backgrounds of the inhabitants, purposes for establishing the towns and range of time during which settlement took place, the physical patterns of most cities remained the same monotonous—and often inappropriate—gridiron. The author reminds us that this habit was not only applied to the eastern United States as well as the western, but was "the plan-form used in all great periods of mass town founding in the past: Mediterranean colonization by the Greeks and Romans; medieval urban settlement in southwestern France, Poland, and eastern Germany; Spanish subjugation of Latin America; and English occupation of Northern Ireland."

Why was the gridiron pattern so relentlessly applied here? There may be many reasons. Most towns were laid out by surveyors, engineers and military officials whose technical equipment, professional skills and limited imagination restricted them to platting straight lines easily set on the ground and described in legal documents. The impetus behind the establishment of a majority of towns was land speculation: the rectangular, regular lots resulting from the gridiron were easily usable, accessible and marketable. The regular gridiron implied a thoughtful, rational process which suggested permanence and security.

There were those who reacted against the application of the gridiron system. A visitor to Cincinnati, Ohio, in 1815 commented: "I have [expressed] my approbation of the American mode of laying out their new towns . . . but I think that oftentimes it is a sacrifice of beauty to prejudice, particularly when they persevere in making all their streets cross each other at right angles *without any regard to the situation of the ground.*"

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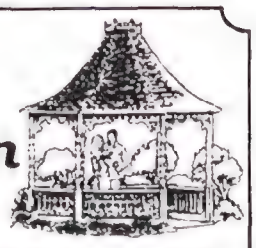

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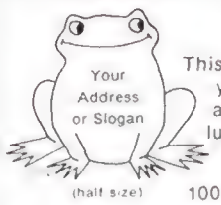

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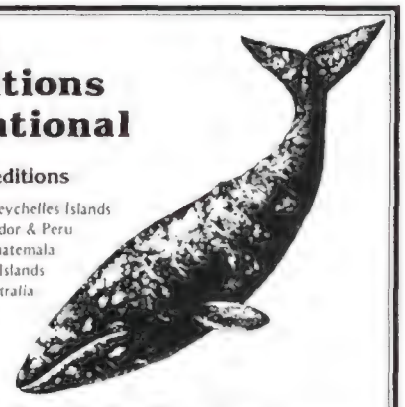

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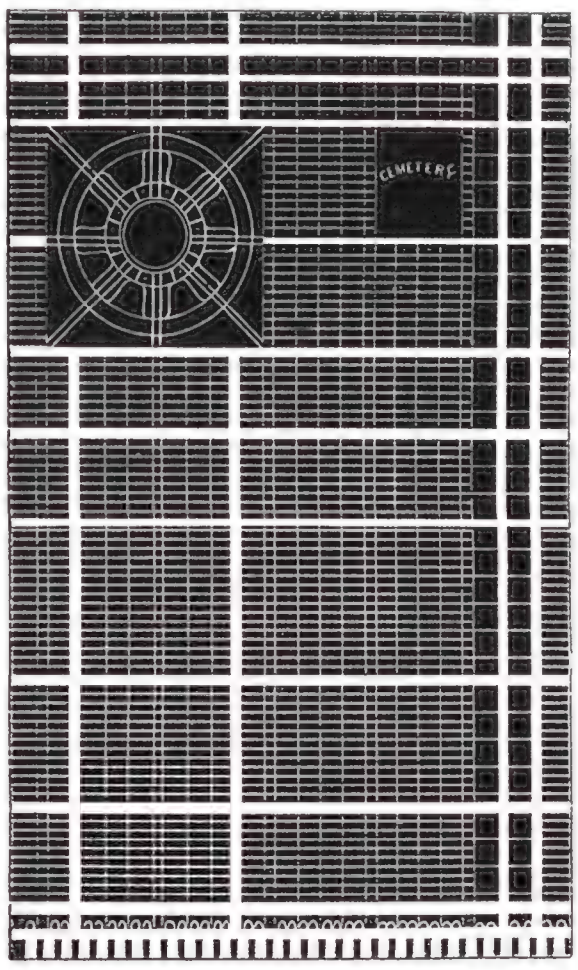
Law Olmsted's sensitive plans for a portion of Berkeley, California, in 1866, and for Tacoma, Washington, in 1873, while combining beauty and utility, were not acceptable to the developers. At the time a critic of the plan for Tacoma observed that it was "the most fantastic plat of a town that was ever seen. There wasn't a straight line, a right angle or a corner lot. The blocks were shaped like melons, pears and sweet potatoes. . . . It was a pretty fair park plan but condemned itself for a town."

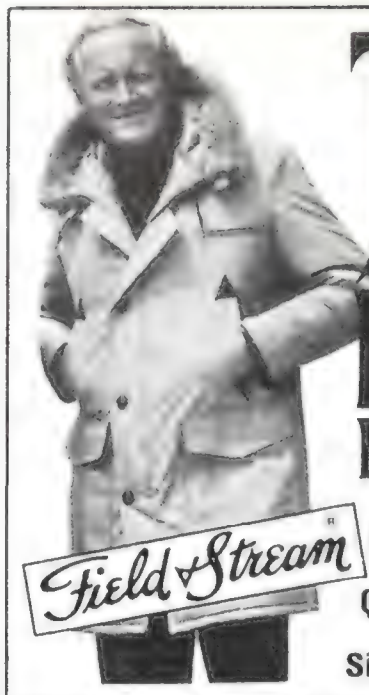
John Reps has admirably described the generative forces and resultant forms of the cities of the American West. He does not pass judgment on the reasons for founding or the subsequent fates of these communities; opinions are communicated through the observations of contemporary visitors and residents. The reader may judge for himself by making comparisons between the 19th-century panoramic views (many in color) presented by Reps and the urban realities of today. Many of the cities are not themselves as rich as this remarkable book.

—*Lee G. Copeland*

Dean, Graduate School of Fine Arts, University of Pennsylvania



Ideal gridiron plan (1872) had a park (upper left), sunken rail and cattle routes.



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Tetons Winter Ecology—March 14-22: In cooperation with the Grand Teton Environmental Education Center, study the delicate balance of nature in winter. Includes cross-country skiing, day trips and evening programs.

New Orleans and Acadia—March 24-31: Learn about the history, architecture and cuisine of New Orleans plus the rich culture of Acadia.

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Asheville, North Carolina—May 2-5: Repeat of a popular program including Biltmore and other historic homes.

Navajo and Hopi Cultures—May 4-13: Visit the land of mesas and canyons, tracing the rich tribal history of these Arizona Indians.

History of the Federal City—May 14-18: Discover the fascinating people and events involved in the origins and development of our nation's capital, including private house tours and behind-the-scenes visit to Congress in session.

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New Zealand—February 20-March 7: Tour includes talks on natural history, the Maori heritage, parliament and home visit. (Tour originates and ends in Los Angeles.)

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Ecuador and the Galápagos Islands—April 18-May 1: Visit Quito, then travel by train to Guayaquil to board the *Buccaneer* for a seven-day voyage through the famous Galápagos Islands. Participate in shipboard study seminars; meet with scientists at the Charles Darwin Research Station; observe the rich plant, bird and animal life.

Springtime in Greece*—May 4-20: A program in Athens and a cruise to Hydra and Aegina are followed by visits to the renowned sites of ancient civilizations when the countryside is a paradise of wild flowers. A mainland tour to the Peloponnesus, Epirus, Thessaly, the Pelion peninsula and the awe-inspiring country around Delphi, through rugged mountains with an amazingly rich array of wild flora.

Russia*—May 18-June 1: Enjoy springtime in Leningrad, Tallinn and Moscow with a two-day excursion to Vladimir and Suzdal; see palaces, the Kremlin, the Hermitage among other museums; life-seeing visits to schools, factories and clinics; visit theater and unique Russian circus.

London*—May 25-June 8: A full program in London with special lectures, walking tours, theater and excursions. A five-day travel seminar into the English countryside offers a selection of areas to be visited.

Isles of Britain—May 30-June 15: From London and Southampton, circumnavigate Great Britain aboard the *Argonaut,* with visits to Dublin, Conway in North Wales, Edinburgh and Dover. The cruise also includes fascinating lesser-known destinations in the Isles of Scilly, the Inner and Outer Hebrides, the Shetlands and the Orkney Islands.

The Wild Highlands of Scotland—May 29-June 14: In cooperation with the Aigas Field Centre, based in a Victorian castle, explore the magical scenery of the central Highland glens. Evening lectures provide a foundation for special hikes and field study of the wildlife and natural history.

Montreal/Quebec—June 14-19: Enjoy the old world charm of these Canadian cities while learning about their cultural history on walking tours and museum visits.

Scandinavian Passage: Fjords and Capitals—August 8-23: From Bergen, Norway, cruise the magnificent Nordfjord and Sognefjorden. Continue to Copenhagen and Visby, Sweden, then cruise the Baltic, calling in at Leningrad and Tallinn before returning to Stockholm. Learn about historic and present-day Scandinavia through lectures and activities ashore and on board the *World Discoverer.*

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American Antique Furniture—March 16-21: Connoisseurship of masterpieces, 1650-1840. Includes color slides of great collections, detection of fakes, care of antiques, and tours of the elegant Diplomatic Reception Rooms of the Department of State, and Winterthur Museum.

China: A Cultural History—March 23-28: Prehistory to the enigmas of today, with emphasis on the intellectual and artistic traditions and the great philosophies and religions. Includes recent films and tours of the Freer Gallery of Art.

Genealogical Research—March 23-28: Leading authorities teach participants how to conduct research in the National Archives, Library of Congress and DAR Library.

French Impressionist Painting—April 13-18: Includes tours of the many masterpieces by Monet, Degas, Renoir and other artists in the collections of the National Gallery of Art and other museums.

A Grand Tour of the Solar System—April 20-25: Leading scientists in planetary exploration at NASA share their new knowledge using slides and films made during the most recent missions. Includes activities at Goddard Space Flight Center and the U.S. Naval Observatory.

Historic Horticulture—May 4-9: Celebrate spring in major 18th-20th century gardens including colonial Mount Vernon, the National Arboretum, and the du Pont estates of Longwood and Winterthur.

The Arts of Japan—May 18-23: Prehistoric culture to the present with emphasis on the great philosophies, religions, and impact of other cultures. Includes films and tours of the Freer Gallery of Art.

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Smithsonian highlights

The rather leggy vehicle below is the Viking Lander, the newest addition to the National Air and Space Museum, and another space-age contrast to the beloved Wright Flyer. The Viking Lander was the first spacecraft to provide a long-term, close-up look at conditions on the surface of another planet. The one on display is a real Viking spacecraft used in ground tests before and during the flight.

Two of these sophisticated, remotely controlled research laboratories touched down on Mars in 1976, scooped up soil and analyzed it on board. Among the facts passed home: the red color of Mars is caused by iron-rich minerals, also that no positive signs of life were detected.

Boredom was to be avoided at all costs aboard the luxury ocean liners of the early 1900s. A new exhibit at the Cooper-Hewitt, *The Oceanliner: Speed, Style, Symbol,* illustrates the scene of those extravagant floating house parties aboard such ships as the *Mauretania, Queen Mary, Normandie* and *Bremen.* Photographs and drawings show ballrooms, promenade decks, recreation halls, salons, and other splendors of shipboard life.

The exhibit also presents the technological side of the transatlantic express—cutaway views and deck plans of machinery, storage, service and accommodation areas for thousands of passengers and crew. Posters, paintings, souvenirs and kitsch reflect the ocean liner as a symbol of the times, a floating self-contained city reluctant to leave the real city behind.

Special January events

Air & Space Museum
Viking Lander—Spacecraft which studied the surface of Mars.
Wernher von Braun Memorial Lecture (January 23, 8 P.M.)—Edward C. Stone, NASA Voyager program, gives illustrated lecture, "Jupiter and Saturn: New Views and Discoveries" (see p. 36).
Black Military Pilots (January 10, 7:30 P.M.)—Seminar features some famous World War II black pilots.
Geared to the Stars (January 16, 8 P.M.)—Dr. Henry C. King, curator of McLaughlin Planetarium, Royal Ontario Museum, traces origin of planetarium.
Space Fiction Films (January 4, 11, 18, 25; 7:30 P.M.)—Free films.
Bull, Dog and Hunter (January 5, 9 A.M.)—Monthly sky lecture, Spacearium.

Cooper-Hewitt Museum (New York)
The Oceanliner: Speed, Style, Symbol (January 22-April 6)—A look at the 20th century transatlantic express.
Tiles (January 29-March 30)—Exhibit surveys history of tiles in East and West, 16th and 20th centuries (picture, p. 140).

Hirshhorn Museum & Sculpture Garden
Fernando Botero (ends February 10).
Oscar Bluemner: The HM&SG Collection (through March 2).
From the Permanent Collection—Works of Josef Albers (through February 17), Raphael Soyer (through January 20), Cubist Heritage (through January 27).

Freer Gallery of Art
Art of the Court of Shah Tahmasp (through March 30)—16th-century works.
Shang Bronzes from the Chang Jiang (Yangtze) River Valley (January 8, 8:30 P.M.)—Lecture by Robert W. Bagley, Harvard University.

Museum of African Art
Children's Workshops (Saturdays, 1-4 P.M.)—Oware workshop—construct an African game, January 5; Animal mask—bring a paper bag—January 12; Appliqué, January 19; Adire dyeing, January 26; free, registration required, call 547-6222, ext. 42.

Museum of Natural History (MNH)
Precious Metals—New exhibit of some 80 specimens of gold and platinum, including nuggets up to 82 ounces.
Life on a Silken Thread—Award-winning film on remarkable life of spiders; Part I, January 4, noon; Part II, January 11, noon; Parts I and II, January 5, 12, 19, 25, 26, noon.
Collecting in Australia, Fiji and New Zealand (January 18, noon)—Illustrated lecture by Dr. Francis Hueber, Division of Paleobotany, Smithsonian.
Family Films—The subject is winter, January 5, 12, 19, 26, 2 P.M.

National Portrait Gallery
Howard Chandler Christy (January 4-August 3)—Exhibit includes the artist's World War I posters, book illustrations and "Christy girl."
The Great Crash (through April 20).

Viking Lander analyzed soil on Mars in 1976; NASM's is test craft.

Renwick Gallery
A Century of Ceramics in the United States, 1878-1978 (through January 27).
Ryijy Rugs from Finland: 200 Years of a Textile Art (through March 16)—Shows development from folk art to fine art.

National Collection of Fine Arts
Drawings of Morris Louis (through February 3).
Hugo Robus (1885-1964) (ends March 2).
Seymour Lipton: Aspects of Sculpture—Traveling exhibit, Brooklyn Museum, through January 20.
Chicago Currents: Koffler Foundation Collection—Traveling exhibition, Anchorage Historical and Fine Arts Museum, January 1-30.

Musical Weekend in May

A concert at Kennedy Center and a performance on 18th-century Italian stringed instruments by the Smithsonian Chamber players are two of the many events planned for the ninth annual Musical Weekend, May 2-4. Sponsored by the Smithsonian's Division of Musical Instruments and the Friends of Music, the program includes meals and hotel accommodations for two nights. For information write: Musical Weekend, Room 4124, Museum of History and Technology, Washington, D.C. 20560.

Radio Smithsonian
This music and conversation program is broadcast weekly on approximately 65 stations across the country. For details, consult your local fine arts radio station. (A different schedule of programs is heard in Washington.)

Japan Today—Discussion of the culture and changing life patterns (week of January 6).

Photographer of the West—Ansel Adams reflects on inspirations; *Families in America*—The family past and present is examined by editors of *Kin and Communities,* a book which grew out of a recent Smithsonian symposium (week of January 13).

Lords of the Jungle?—A look at what is being done to help preserve some rare lions and tigers at the National Zoo; Time's *Entertainment*—How the stars have been portrayed on the magazine's covers (week of January 20).

Dylan Thomas: The Man and the Myth—British actor and educator David Ponting talks about the poet; *Music by Bach*—Played as the composer would have heard it by members of the Aston Magna Foundation (week of January 27).

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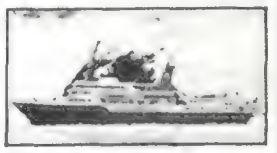

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Regional events

January and February find Smithsonian in Florida for the start of the 1980 Regional Events Program. The programs in Miami, January 30-February 9, and in West Palm Beach, February 4-9, cover a variety of topics, including historic horticulture, nature photography, the gardens of Europe and Caribbean volcanoes. Associates who spend the winter in Miami and the Palm Beach area but receive SMITHSONIAN magazine elsewhere may request invitations by writing: Regional Events, 1208 A&I, Smithsonian, Washington, D.C. 20560.

Later this year, programs will be in San Antonio (March), Des Moines (April), St. Louis (May), Grand Rapids (May) and Anchorage and Fairbanks (September). Programs are cosponsored by local cultural and scientific organizations. Invitations are sent to National Associates in these cities about a month in advance.

Smithsonian events

Special events and performances in January are listed below. For tickets, call (A) 202-381-5157 or (B) 202-381-5395, as noted in the listings.

Discover Acting! (January 2-27)—Stephanie Rich explores fantasy of the stage world, Discovery Theater, A&I, Wednesdays-Fridays, 10, 11:30 A.M.; Saturdays, Sundays, 11:30 A.M., 2 P.M. (B)

Romantic Chamber Ensemble (January 7, 8 PM., Baird, MNH). (B)

I Made Bandem (January 13, 8 P.M., Baird)—Balinese dance performance; free lecture-demonstration, January 12, 3 P.M., Baird. (B)

American Dance Experience (January 14, 8 P.M., Baird)—Melvin Deal and the African Heritage Dancers; free demonstration, January 13, 3 P.M., Baird. (B)

Keyboards (January 14, 8 P.M., Hall of Musical Instruments, MHT)—Kenneth Drake and James Weaver perform Beethoven on two English pianofortes. (B)

Americans in Space on Film: Part II (January 15, 22, 29, February 5, 8 P.M., Baird) —Documentaries, discussions. (A)

Art and Architecture of Ancient Greece (January 19, 10 A.M.-5:15 P.M., Carmichael, MHT)—Seminar led by classical scholar Robert S. Bianchi. (A)

Elvin Jones (January 20, 6 P.M., Baird)—Jazz concert. (B)

Edward Steichen: Another Look (January 23, 8 P.M., HM&SG)—Marianne Margolis, Curator at International Museum of Photography, George Eastman House, discusses Steichen's work. (A)

The Rocket Team (January 24, 8 P.M., Baird)—Author Frederick I. Ordway III traces history of rocket technology. (A)

Voices of the Civil Rights Movement (January 30-February 3, MHT)—Songleader's workshop plus colloquium; for information, call 381-6781.

Spanish Alcora tiles at Cooper-Hewitt

Smithsonian Institution Traveling Exhibition Service

SITES circulates exhibitions to hundreds of cities outside Washington, D.C. To sponsor a show in your community, write to Eileen Harakal, SITES, Smithsonian Institution, Washington, D.C. 20560. Here are some January exhibits:

San Bernardino, California (January 12-February 10)—*Images of Old Age in America,* California State College Library.

Littleton, Colorado (January 12-February 10)—*Inuit Sculpture,* Arapahoe Community College Gallery of Art.

Coral Gables, Florida (January 19-March 2)—*Phillips Collection in the Making: 1920-1930,* Metropolitan Museum and Art Centers.

Jacksonville, Florida (January 19-March 2)—*Daum: 100 Years of Glass and Crystal,* Cummer Gallery of Art.

Athens, Georgia (January 26-February 24) —*Paper as Medium,* University of Georgia.

Decatur, Illinois (January 26-March 23)—*American Drawings,* Millikin University.

Logan, Kansas (January 5, February 3)—*Images of Earth from Space,* Dane Hansen Museum.

Wichita, Kansas (January 26-February 24) —*The Great West, Real/Ideal,* Ulrich Museum.

Louisville (January 5-February 3)—*Quintessential Quilts,* J. B. Speed Art Museum.

Baltimore (January 5-February 3)—*Audiences of the Moon: Photographs from the Age of Lunar Exploration,* Maryland Science Center.

Buffalo (January 19-February 17)—*Butterflies!* Buffalo Museum of Science.

Athens, Ohio (January 5-February 3)—*Erté,* Trisoline Gallery (SMITHSONIAN, December 1979).

Virginia Beach (January 5-February 3)—*Graficas: Contemporary Latin American Prints,* Virginia Beach Art Center.

Tampa, Florida (January 26-March 9)—*Reflections: The Child in America,* The Tampa Museum.

Carterville, Illinois (January 19-February 17)—*Coast-to-Coast Coasters,* John A. Logan College.

Detroit, Michigan (January 12-February 24)—*The Working American,* Detroit Historical Museum.

Membership benefits when visiting the Smithsonian

The Associates Reception Desk, in the castle, is open from 10 A.M. to 4 P.M. daily for registration, event-exhibit information and orientation material.

The Associates Lounge in the castle, a quiet place to relax, is open from 10 A.M. to 5:30 P.M. daily.

The Members' Dining Room, **"The Court,"** in the Museum of Natural History, is open Monday through Friday for lunch (11 A.M.-3 P.M.); on weekends for breakfast (8:30 A.M.-11 A.M.) and for brunch (11 A.M.-3 P.M.). Enter via Constitution Avenue for breakfast.

For pre-visit information packet, send postcard or phone Associates' Reception Center, Smithsonian Institution, Washington, D.C. 20560 (202-381-6264 or TTY 202-381-4448). Allow two weeks.

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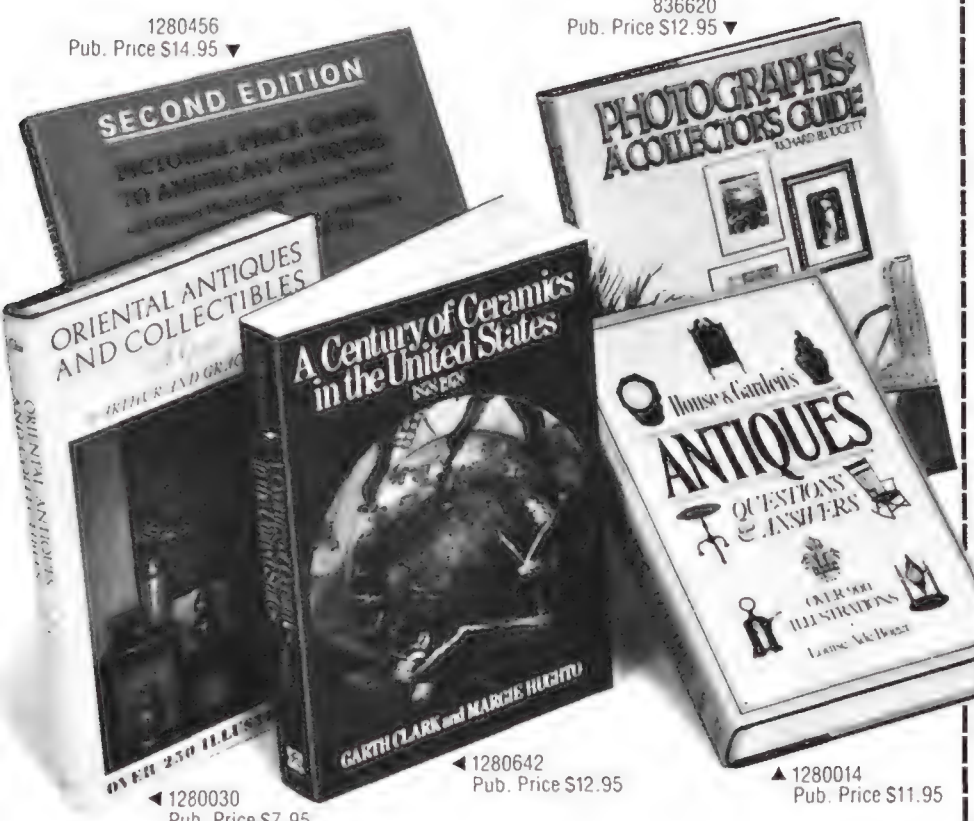

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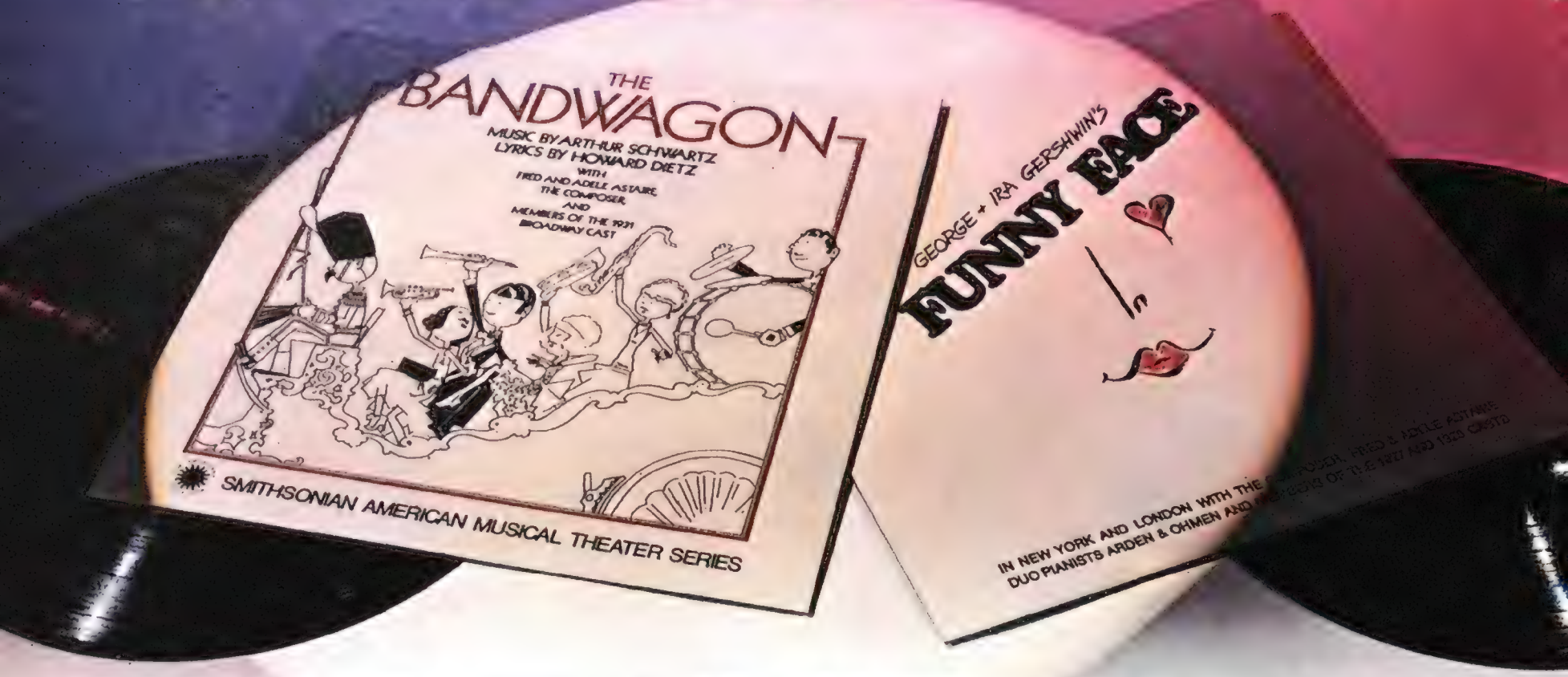

There's no business like show business . . . and there's no record series like the Smithsonian American Musical Theater Series! Cast albums today are nothing out of the ordinary, but before 1943 there was no such thing. But there were the songs, often recorded by the stars, the featured players, and the composers. The Smithsonian has tracked down which stars recorded what songs for which labels—piecing out those with broadcast material and even piano rolls. The result . . . as close as you can get to experiencing the original show.

The Band Wagon—This recording recaptures the theatrical magic of Dietz and Schwartz's highly innovative musical revue. The 1931 hit features the brother–sister team of Fred and Adele Astaire (her farewell to the stage) and the lyric *Dancing in the Dark.*

Funny Face—Another Astaire hit! With brother Fred as guardian and sister Adele as his flapper ward **Funny Face** opened to raves in November of 1927. And a sibling success it was—with Ira and George Gershwin penning such memorable songs as *'S Wonderful* and *My One and Only.*

Let's Face It
Wit and elegance abound in these three Cole Porter shows. The 1941 reconstruction of **Let's Face It** features the antics of a young Danny Kaye. Selections are also included from the 1936 production starring Ethel Merman (**Red, Hot and Blue!**) and the 1938 show which introduced a demure Mary Martin (**Leave It to Me!**). *Including: Ev'rything I Love • My Heart Belongs to Daddy*

Lady, Be Good!
The original 1924 production is reconstructed with performances by Fred and Adele Astaire (one contains *his* first dancing on records) and by George Gershwin himself. The selections have been taken from several sources, including some Gershwin radio broadcasts. *Including: Oh, Lady Be Good • Fascinating Rhythm • Half of It Dearie Blues • Hang on to Me*

Oh, Kay!
A Long Island bootlegging operation is the setting for this musical written especially for Gertrude Lawrence. Frequently revived, selections from this popular Gershwin show are now available in a 1926 edition—with performances by Lawrence, Gershwin, and duo pianists Arden and Ohman. *Including: Someone to Watch Over Me • Do, Do, Do • Clap Yo' Hands • Maybe*

Souvenirs of Hot Chocolates
Featuring music composed and performed by Fats Waller, this all-black revue marked the Broadway debut of Louis Armstrong. Songs, comedy sketches, and dance numbers are all part of this night club show so opulent that it was moved to Broadway. *Including: Ain't Misbehavin' • Sweet Savannah Sue • Black and Blue*

Ziegfeld Follies of 1919
Enthusiastic audiences applauded Eddie Cantor, Bert Williams, John Steel, and the popular team of Van and Schenck in the 1919 edition of the Follies. This album features those stars performing 17 numbers, five composed by Irving Berlin. *Including: A Pretty Girl Is Like a Melody • Mandy • You'd Be Surprised • I've Got My Captain Working for Me Now*

Whoopee
Eddie Cantor, Ruth Etting, and George Olsen's band and singers are all here on this reconstruction of Ziegfeld's Wild West extravaganza. The musical program is almost complete, including an overture. *Including: Love Me or Leave Me • Eddie Cantor's Automobile Horn Song • Makin' Whoopee!*

Anything Goes
Since its 1934 Broadway triumph, this shipboard musical comedy has been an American favorite. Archival recordings made by the original New York and London cast members—including Ethel Merman—and by Cole Porter himself recreate the 1934 show. *Including: I Get a Kick Out of You • You're the Top • Anything Goes • Blow, Gabriel, Blow.*

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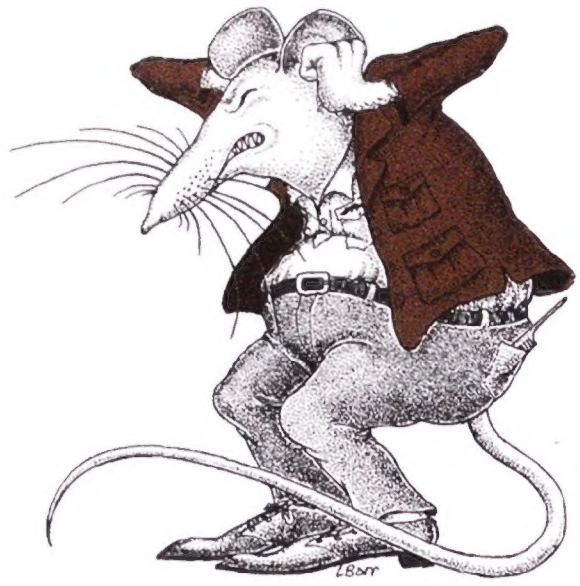


Closing time may be at hand for any ambitious inventor still laboring deep in the woods to verify Emerson's dictum that if he can make a better mousetrap than his neighbor, the world will beat a path to his door. As the world wags, it may not need a better mousetrap any more. In the unending battle between Man and mouse, the traditional cheese-loaded weapon soon could be obsolete. Enticement to voluntary execution may become an outmoded tactic; resonant repulsion may be the order of the day.

Presage of such a sonorous switch was recently reported in no less than *New Scientist* regarding "a new electrical device [that] clears a building of rodents by emitting a 96 dB ultrasonic screech. The Italian manufacturer, Erti Electronics of Tradate, claims that mice and rats simply cannot stand the noise and beat a hasty retreat. . . . The device is left running all the time and . . . clears 250 square meters of any infested building within a week."

Fellow amnesiacs, whose perverse minds forget this morning's marital instructions but recall verbatim the poems of childhood, may be reminded by this sonic attack on Rodentia that the Pied Piper of Hamelin used a similar high-pitched ploy back in 1376. In Robert Browning's poem, anyway, the Pied Piper blew "three shrill notes" upon his pipe "And out of the houses the rats came tumbling./Great rats, small rats, lean rats, brawny rats,/ Brown rats, black rats, gray rats, tawny rats." And they scurried after him to plunge lemminglike and perish, all but one, in the waters of the River Weser.

Could it therefore be that a tootling European rat evicter knew a thing or two about ultrasonics in the 14th century? Had the Pied Piper already worked out by random fingering the 20th-century principles of pest expulsion and thus was able to deliver that 96-decibel ear piercer that finally drove the Hamelin vermin headlong into a watery grave?

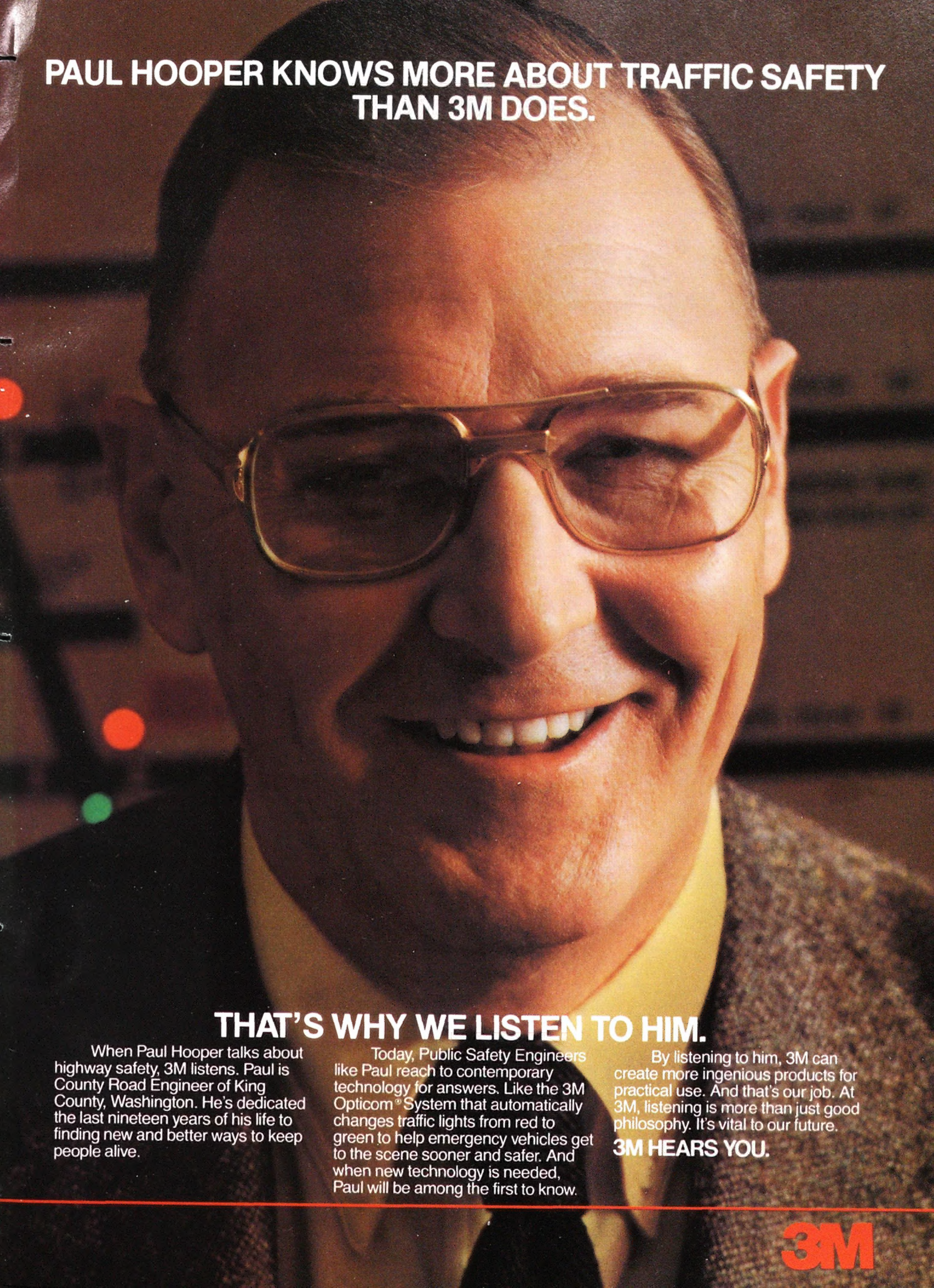
Transatlantic progress in de-micing by decibels was exemplified in the well-publicized news of a musical gentleman, Mr. Bob Brown of Pine Valley, California, who, while putting together an electric guitar in 1972, tangled some wires and inadvertently produced a sound that sent the local rats scattering. Further experiment with these harmonics produced a "rat repellent box" that issued "a sound so shrill . . . it drives rodents wild, kills cockroaches and sends fleas flying." Mr. Brown's mousetrap is now "the Ecology Machine" and since more than 50,000 models have already been sold worldwide at $100 to $500, Mr. Brown himself is something of a millionaire.

He explained that the frequency of his banishing blue note was many times beyond the range of 20,000 cycles (Hertz), which is about the limit that can be heard by the human ear. Rodents or vermin within its range apparently become so disoriented that "their normal life cycle is dramatically affected. They either flee, or become 'stunned' and act in an erratic fashion, not eating, drinking or mating. Many simply curl up and cease to function and thus dehydrate." Not only that, but tests show that there are "no harmful effects at all on humans or farm animals."

That such humanly undetectable sounds could upset mice was supported in England by another gentleman who once shared a large old house in the Crystal Palace district of London with a vigorously fertile colony of four-legged enemies. No matter what measures he used to exterminate them, the mice bred faster until the BBC intervened by erecting a television mast nearby. The mice then fled, "almost overnight," and a BBC engineer explained that "a high-frequency hum, inaudible to us but not to the mice, had made life intolerable for them."

Direct vocal attack on rats was once practiced in Ireland, where it was an old belief that they could be driven from pastureland by solemnly cursing them in rhyming verse or metrical charms. This process was well enough known to be referred to by reputable authors up to the 17th century, including William Shakespeare himself, who had Rosalind complain in *As You Like It,* when Orlando festooned the forest of Arden with his love lyrics, "I was never so berhym'd since Pythagoras' time, that I was an Irish rat, which I can hardly remember."

There is, however, one small doubt in my mind about the ultimate, communal efficiency of these sonic-eviction devices which simply flush the mice and rats out of the premises in which they presently have their home. Once out of earshot, the displaced vermin will just move on to take up new residence someplace else. At which, their adopted host will have to buy a humming repellent himself and drive them out onto the streets once again. Thus a nation doesn't get rid of its varmints but just keeps them continually on the move from one human habitation to another. Finally, perhaps, all rodents on the run may well drop dead from sheer physical exhaustion.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